Curtin Business School
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Developing a Model for Explaining Network Attributes and Relationships of Organised Crime Activities by Utilizing Network Science

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DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signed by:

Martin Botha

Date: **2017-11-17**

Abstract

Purpose

The purpose of this research project is to address the key highlighted shortcomings as outlined in chapter one, viz. the lack of knowledge and so-called ineffective prevention of organised crime. This is accomplished by examining the phenomenon from a non-legal perspective and then developing a tool in the form of an exploratory model that encompasses network science as the core component. It is envisaged that this model could ultimately be used by organised crime investigators and the research community to investigate and scrutinise substantive complex organised crime cases.

Methodology

This thesis adopts two main stream methodologies to investigate organised crime and to forge new opportunities to address the current deficiencies associated with the investigation and research of the phenomenon. Firstly, the phenomenology methodological theory is selected as the framework to investigate organised crime and to gather important information, based on an extensive literature review. Secondly, design science research methodology is espoused to delineate a conceptual exploratory model to examine and comprehend organised crime activities more effectively and efficiently.

Moreover, the thesis is both theoretical and practical in nature, as review of literature is used to identify the main critical attributes (independent variables) necessary for investigating individuals and relationships of organised criminal groups and activities. Also, the attributes are confirmed by means of case study research and a new novel conceptual model is developed, after which the model is practically implemented and evaluated by means of a rapid prototyping.

Findings

The study underlines thirty critical independent variables related to organised crime, which are based on general crime, social-psychological, sociological and social network concepts. Case study research on substantive organised crime cases has revealed that a number of these variables are already frequently used by the legal and reporting communities to articulate and scrutinise criminal cases, whilst information on the remaining variables is also available. In addition, the results suggest that social-psychological variables are more suited to articulate the behaviour of organised crime offenders, compared to sociological variables. Moreover, the results further concluded that most organised crime offenders do follow general/typical actions and methods whist conducting their organised crime activities. Further to that, the rapid prototyping which processes all the variables and concepts of the exploratory model, has illustrated the real potential of network science as a platform to discover new insights about the wicked phenomenon, the relative easiness to implement the new model, as well as the prospects of the new model to enhance the outcome of organised crime detection, investigation and research.

Limitations

A diverse range of literature is considered for identifying and comprehending the main critical attributes (independent variables) of organised crime. However, only eleven substantive cases are utilized to confirm the suitability and validity of the attributes. Furthermore, only readily available traditional sources of information related to these cases are considered for this project, i.e. court summary documents and news articles. As this research project is a first attempt to shed more light on the complex phenomenon by means of focusing on critical attributes of the crime and network science, future follow-up projects could consider additional substantive cases, as well as additional contemporary sources of information, such as Social Media, Instant Chat Services and so forth. Moreover, additional substantive cases could also be used to further evaluate and scrutinise the effectiveness of the prototype, as delineated in this project.

Originality

The research reported on in this manuscript is a first attempt to examine organised crime from a holistic perspective, i.e. to take a comprehensive list of core crime related aspects into consideration when identifying the critical independent variables required to analyse the phenomenon, by assessing general crime, social-psychological, sociological and social notions. These notions are further uniquely implemented within a theoretical sphere by means of network science and social science concepts and strategies.

In addition, the research also provides a useful tool and guidelines for both academics and practitioners to consider and conduct organised crime investigations and prosecutions, especially where a limited amount of source data is available. As a consequence, the envisaged harvesting of knowledge that could occur when applying the tool to real organised crime cases, should contribute to the ultimate construction of an overarching framework for organised crime in the future.

Practical Implications

The exploratory model and prototype, as proposed in chapters 7 and 8, have the potential to be applied to most substantive cases in order to assist researchers in their quest to unearth new knowledge about organised crime and for law enforcement to effectively and efficiently investigate the phenomenon. Furthermore, the evaluation of the prototype has also shown the potential for the model to be incorporated into existing crime investigation software packages, as many information sources of the variables are readily available.

Keywords

Network Science, Design Science, Organised Crime.

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Chapter 1

The Introduction

Introduction

This chapter focuses on:

- Providing a synopsis on organised crime in the twenty-first century;
- Articulating the associated research problems and challenges;
- Explaining the significance and importance of this research;
- Explicating the objectives of the project; and
- Presenting the organisation of this thesis.

1.1   Overview of Organised Crime

Organised crime in its basic form can be dated back many centuries (Wright, 2006, p.102; Morrison, 2010, p.3; Leong, 2016, p.1; Spinuzzi, 2016, p.1) and has *continued to evolve* as a function of its success, especially in the last twenty years (Murray, 2013, p.107). According to the Federal Bureau of Investigation (FBI), organised crime has developed into such a lethal phenomenon that it poses one of the greatest threats to the national and economic security of the United States of America (FBI, 2017, p.1). This sentiment is echoed by the Australian Defence and Security Department (ADSD) by asserting that "organised crime represents significant and persistent risk to the Australian government, businesses and individuals" (Barker, 2017, p.1). As a result, serious and organised crime was registered as one of the seven key national security risks in the 2013 National Security Strategy (Barker, 2017, p.1) and currently remains a listed security risk.

The *threat from organised crime* in the twenty-first century is intensified due to the appearance of the concept of transnational organised crime (Leong, 2016, pp.1-2) – organised crime that is commissioned at a global level and reached macro-economic proportions. A simple instance of this occurrence is where illicit goods that are sourced from one continent, then trafficked across another continent and finally marketed in a third continent (Madsen, 2009, p.2). Although it is very difficult to accurately measure the impact of this threat, the FBI conservatively estimated that *global organised crime reaps illegal profits of almost $1 trillion per year* (FBI, 2011; Barker, 2017, p.1). According to Barker (2017), the recovering rate of these illegal profits is extremely low and is estimated at around 0.2% of all total illegal profits.

Moreover, organised crime in Australia is also evolving and is on the rise (ACC, 2016, pp.83-84). The *organised crime* phenomenon in Australia has been estimated to *cost the economy annually between $10 and $15 billion* (Barker, 2017, p.1) and is accountable for much of the nation's serious crime (AIC, 2016, p.1). In Australia, most of the successful crime groups/organisations generate these illegal profits by operating across many sectors and commit one or more crime categories (i.e.

aggravated assault, burglary and so forth). However, most of these groups typically are involved in some form of financial crime or money laundering related activities. In most cases they will also have some connection with the illicit drug markets and may be involved in crimes, such as people or firearms trafficking, fraud or technology advanced crime (Australian Institute of Criminology, 2011).

The organised crime activities committed in Australia and globally exhibit significant similarities in terms of *threats and trends*. Research conducted by both the Australia Crime Commission (ACC) and Europol has revealed three major threats and trends in organised crime occurring both in Australia and internationally (Barker, 2017, p.1), viz.:

- The increasingly fluid and networked nature of organised criminal groups;
- The emergent operational and technical sophistication of the crime includes amongst others, the exploitation of complex legal business structures and professional expertise, the taking advantage of technical vulnerabilities of systems, the utilization of state of the art technologies, and so forth; and
- The important role of enabler activities, such as money laundering, identity crime and corruption (Leong, 2016, pp.1-2; Roth, 2016, pp.1-2).

The *fluid and networked nature of organised crime groups* is accentuated by the fact that many groups encompass members that could be located in one or more hemispheres, i.e. Eastern, Western, Northern and Southern hemispheres (FBI, 2017, p.2). Further to that, group members may have ethnic or cultural ties to Europe, Africa, Asia and the Middle East. Also, the group members may come from all spheres of society, namely the elite business class or the working class of the society (Dobovsek & Slak, 2015, pp.305-312). As noted by the FBI (2017), these groups could function in a diverse range of structures, which include amongst others, hierarchical structures, clans, well-formed networks, independent cells, and so forth.

Another *important characteristic of the organisational structure of the groups* is the reporting mechanism. Organised crime organisations are held together not only by formal reporting and authority networks, but also by informal networks that connect people across numerous layers of hierarchical or other organisational structures (Madsen, 2009, pp.1-16). Furthermore, criminals not only form networks of contacts within their own organisation, but also among other organisations to ensure that they can perform their illegal activities with relative ease. In addition to networks of people, criminal organisations include networks of knowledge, resources, and skills (Australian Institute of Criminology, 2011).

The *emergent operational and technical sophistication of the crime* can arguably be attributed to the fact that organised crime syndicates have managed to intertwine with legitimate businesses and governments, incorporate professionals or experts in their organisational structure, and adopt and exploit new technologies to enter and operate in new markets (Leong, 2016, pp.1-2; Dobovsek & Slak, 2015, pp.305-312). Organised crime organisations are entering the business/governance sphere by either setting up their own legitimate business or by taking over control of a legitimate business by means of funding, corruption or extortion. The motives for owning or taking over businesses range from opportunities to participate in money laundering, to the aspiration to operate a legitimate business (Abadinsky, 2010; Savona, 2010). The result is the amalgamation of legitimate

and illegitimate activities to such an extent that it is extremely onerous to identify the difference between the two (Murray, 2013, pp.99-107).

Another reason for the increased sophistication of the groups relates to the *supreme level of skill sets and technologies* exerted by the group members (Spinuzzi, 2016, p.2; Roth, 2016, p.473). Murray (2013) asserts that organised crime groups are increasingly obtaining access to business strategists, chartered accountants and finance professionals to provide them with a competitive advantage over law enforcement and other crime groups. These organisations are also employing highly trained technical experts to compromise targeted networks, to create anonymity and distance from their crime which makes it difficult for law enforcement to detect, and to train the working class of the criminal groups (ACC, 2016, p.7). Consequently, most of the ground workers are able to utilize basic tools, techniques and technologies, such as mobile and satellite phones, e-mail accounts and social networks to more sophisticated techniques, such as, encrypted communication networks, steganography, dark internet Websites, encrypted e-mails and so forth to perform their criminal and deviant acts (Roth, 2016, pp.472-494).

The ACC has identified *six important activities which enable organised crime groups* to perform or support their illicit activities. The six activities comprise money laundering, cybercrime and technology-enabled crime, identity crime, criminal exploitation of business structures, public sector corruption and violence (ACC, 2016, p.11). These activities are classified as 'enablers' as they have unique roles in enabling or facilitating organised crime acts. It is important to note that these enablers would most probably not be committed if other preceded illicit activities had not occurred. For instance, money laundering is performed to conceal the proceeds of illicit drug sales. Hence, if illicit drugs were not sold, money laundering activities would be unnecessary (ACC, 2016, p.12).

Furthermore, activities such as money laundering, identity crime, corruption and violence contribute to the *effectiveness of other types of organised crime* (Leong, 2016, pp.1-2). Even though not all of the enablers listed above are present in every illicit market, one or more enablers can be employed in unity. For example, one organised crime group could use one enabler only to facilitate the criminal act and another group might opt for several enablers at once. Importantly, corruption is mostly being utilized to facilitate or conceal the use of other enablers.

Contrary to the rapid advancements made by many organised crime organisations, it appears that many law enforcement agencies continue to use traditional intelligence gathering techniques together with modern data analysis tools and cross-agency partnership programs to investigate and counteract organised crime (Murray, 2013, p.100). However, according to Lawler (2010) organised crime has become so complex, serious and pervasive that the existing investigative approaches are no longer adequate to combat the phenomenon. More importantly, the author explicitly stated that law enforcers need to improve the strategic understanding of organised crime in Australia and develop new, innovative and more effective responses to it (Lawler, 2010). Murray (2013) agrees with Lawler (2010) and further accentuates the need for law enforcement to advance themselves with professional skills held by chartered accountants, finance professionals and business strategists.

The *purpose of this chapter* is firstly to highlight how contemporary organised crime trends and threats, as articulated above, have motivated this research project. Secondly, the chapter aims to

vividly pronounce the research objectives of the project. Finally, it provides a roadmap of how the research objectives are achieved on a chapter-by-chapter basis.

Consequently, the chapter commences with the contextualization of the motivational factors that inspired this research project, followed by a brief discussion on the envisaged significance of the project. Thereafter, both the primary and secondary objectives of the thesis are articulated. Finally, the chapter concludes with a roadmap for the rest of the thesis, which includes a short synopsis of each chapter.

1.2   Motivation for Research

The *organised crime phenomenon has grown exponentially* during the last two decades, to such an extent that it has become extremely diverse, lethal and sophisticated (Morrison, 2002, p1; Dobovsek & Slak, 2015, p.306; Leong, 2016, pp.1-2).   Subsequently, law enforcement agencies and governments are continuously searching for new strategies, models and approaches to combat this phenomenon (Lawler, 2010).   Moreover, there is a *lack of a suitable universal overarching framework and/or model* that could be used by law enforcement to scrutinise substantive historical and current cases (Spinuzzi, 2016, p.4; Morrison, 2002, p.2). Researchers, on the other hand, find it equally challenging to articulate an overarching framework and/or model due to the *finite amount of detailed information* on factual organised crime cases (von Lampe, 2012).

Notwithstanding these challenges, a *wide range of studies* was undertaken by researchers to gain insights into the organised crime phenomenon, which include topics such as Approaching Organised Crime by Morrison (2002), Transnational Organised Crime Challenges by Von Lampe (2012), Anatomy of a Dark Network by Demiroz & Kapucu (2012), Measuring Transnational Organized Crime Threats to US National Security by Spinuzzi (2016) and The Legal and Administrative Mechanisms in the Control of Organised Crime by Leong (2016), to name a few. Further to these research projects, many other accredited organisations such as the United Nations Office on Drugs and Crime and Australian Institute of Criminology (AIC), together with governments such as the United Kingdom (UK), United States (US) and Australian government, are also continuously researching the complex phenomenon. The main purpose of these studies is to understand modern trends of organised crime syndicates and the impact of their actions on all domains of the society, which would enable them to define strategies that will keep them 'one-step-ahead' of organised crime perpetrators. However, most of these studies have highlighted *unresolved key challenges and problems* pertaining to the phenomenon, which accentuated the need for conducting further research to acquire a more profound understanding of the complex specialised crime occurrence.

In order to address the notorious challenges and problems related to this phenomenon, the research project follows a *cross-disciplinary research approach*, where contemporary organised crime activities and trends are investigated, assimilated and conceptualised. Also, a novel solution model, is developed by applying concepts and approaches from other well established academic disciplines, such as general criminological theories, network science, design science and general Information Technology (IT) concepts.

Subsequently, as a result of the severe impact of organised crime, i.e. harm to the economy, society, democratic institutions, democracy in general and so forth (Tusikov, 2011, pp.99-108), as well as the key challenges highlighted above and in previous research efforts, the *research project* was initiated with the following general *aims*:

- To research or develop an organised crime classification system that could serve as reference or baseline for evaluating substantive cases and to discover profound knowledge of the phenomenon.
- To explore or develop alternative measures or variables to analyse various core aspects of historical and current cases, thereby overcoming the challenge of limited case related information.
- To identify or cultivate a suitable mathematical model to transform the measured variables into meaningful inferences.
- To develop a conceptual model that enables meticulous and systematic explication of the measurement process.
- To prototype the conceptual model for feasibility testing.

These aims are addressed by examining the following two overarching research issues:

- **Research Issue I:** Addressing the insufficient data, information and knowledge concerns that encumber effective investigation, control and counter-action against organised crime syndicates.
- **Research Issue II:** Addressing the absence of a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently.

Each of these issues is further articulated in sections 5.2 and 5.3 of this thesis.

1.3 Significance of Research

The key research aims and issues for this thesis were briefly highlighted in the preceded section. The remaining chapters meticulously and systematically elucidate the methodology employed to address the aims and issues, as well as the evaluation of results achieved and inferences drawn from the results. Hence the detailed significance of the research is accentuated in the outcome of each chapter. However, the overall significance of this project comes to prominence whilst analysing the research aims and issues. As such, the project offers, amongst others, three distinct contributions, namely:

1.3.1 Contribution to Theory:

- This thesis presents an overarching holistic taxonomy that encompasses the most important aspects or components of organised crime. The new taxonomy could be used by researchers and law enforcement agencies to identify commonalties and

- differences within the group and amongst the different groups, infer common trends and enablers, and develop effective counter measures and/or models (chapter 2).
- The research program investigates organised crime from a holistic point of view (i.e. general crime concepts as well as social-psychological, sociological and social networks perspectives) by articulating a broad spectrum of attributes or variables related to the phenomenon (chapter 3).
- The research provides a better understanding of how individuals and groups act within an organised crime environment, the different relationships that are formed within the networks, the important influential factors that determine the outcome of group actions, a method to identify the most vulnerable member in the group, the control of the flow of information, the modus operandi of members in the group, and so forth (chapter 4).
- This study provides an alternative investigation methodology by exploring network science and social science concepts (chapter 4).
- The research proposes a conceptual model whereby researchers and law enforcement could examine historical and current organised crime cases (chapter 7).
- The study includes a rapid prototype in which the proposed conceptual model is theoretically tested and analysed (chapter 8).

1.3.2 Contribution to Practice:

- This thesis demonstrates, in a practical manner, how to apply the investigation methodology (i.e. five steps exploratory approach (section 4.5) and implementation strategy (section 7.6)) on substantive organised crime cases (chapter 8).
- The investigation methodology also provides researchers and law enforcement agencies with possible guidelines to proactively counteract organised crime networks (chapters 7 and 8).
- The proposed conceptual model could assist law enforcement and policymakers in developing more effective scientific strategies to combat organised crime (chapter 7).

1.3.3 Contribution to Society:

- The deliverables of this project could eventually be utilized in the future to protect democracies, government institutions and communities against harm caused by organised crime groups, through an improved and effective investigation and conviction effort (chapters 7 and 8).

1.4 Objectives of Research

Having defined the key research aims, issues and significances of this project previously, this section now states the prescribed (primary and secondary) objectives of the project. The two core objectives are as follows:

The *main objective* of this research project is to determine whether or not network and social sciences can be utilized to cultivate an alternative approach to investigate organised crime.

The *secondary objective* is four-fold, namely:

- Firstly, to devise a universal overarching conceptual model that incorporates network and social sciences concepts;
- Secondly, to propose an implementation strategy to operationalize the model, insofar that researchers and law enforcers could apply the conceptual model on substantive organised crime cases;
- Thirdly, to formulate a practical novice approach through which the model could be evaluated; and
- Finally, to make a determination whether or not the new proposed model could be used to investigate organised crime networks effectively and efficiently.

1.5 Structure of the Thesis

The thesis encompasses nine chapters. The remaining eight chapters are structured as follow:

Chapter 2 provides an in-depth review of organised crime in general by analysing both ancient and contemporary organised crime groups in terms of their traditions and structures. Attention is also given to discuss the wide range of definitions exerted to articulate organised crime, resulting in the selection of an internationally acceptable definition to accurately describe the phenomenon for further use in this thesis. This leads to more literature review discussions on current investigative and counter measures used by governments and law enforcement agencies to combat the sophisticated crime, along with a preview of the envisaged future of organised crime. The chapter concludes with a classification of the phenomenon by delineating a holistic taxonomy.

Chapter 3 continues with the literature review by briefly introducing general criminological theories associated with crime and criminality. This is followed by presenting a high-level overview on two prominent group-related criminological theory streams, i.e. social-psychological and sociological streams. Thereafter, concepts of modern social networks are discussed with special emphasis on network characteristics, network interrelationships and communication dynamics. The chapter closes with the compilation of the most important and suitable attributes or variables that characterize important aspects of organised crime, each of them pertaining to the various criminological theories.

Chapter 4 concludes the literature review by introducing concepts of network science, which includes among others, the highlighting of different types of network measures available to map the variables into mathematical representations. The final part of the chapter focuses on an approach that collates and explores the mathematical representations, ultimately enabling the application of network science to contemporary organised crime investigations.

Chapter 5 focuses on research methods and commences by defining the main research problems identified during the comprehensive literature review. Based on the nature of the research issues and questions, the chapter continues to explicate a multi-research-methodological approach adopted to address the defined problems and issues. Finally, the most appropriate research method relating to each research methodology is selected and discussed.

Chapter 6 concentrates on establishing the usability of the variables (as defined in chapter 3) insofar as to represent the core aspects of organised crime cases. The variables are tested on eleven substantive organised crime cases and the results are presented, together with the articulation of frequency distributions, descriptive statistics and most important facts obtained through the study.

Chapter 7 proposes a conceptual model that explains how the list of variables and network science concepts could be implemented by researchers and investigators to scrutinise and unpack complex organised crime cases in a meticulous way. For this reason, the chapter focuses further on an application strategy for implementing the model theoretically.

Chapter 8 shifts the attention to the practical evaluation of the model and implementation strategy, by means of a software prototype. Importantly, the focus for this chapter is to determine the practical feasibility and usefulness of the new proposed model to researchers and law enforcement. The eleven substantive organised crime cases are once again being exerted for evaluating the model and the results are presented, articulated and argued for validation purposes.

Chapter 9 concludes the thesis by summarising the key findings observed throughout each chapter. This includes an articulation of the results and major benefits of the research, together with suggestions for future work in the burgeoning field of organised crime.

Annexure A presents a low-level tabularisation of the exploratory process as outlined in chapter 4, by combining the findings and deliverables of chapters 3 and 4. The purpose of this annexure is to exhibit how basic network science concepts could be applied to the list of variables as outlined in chapter 3.

Annexure B elaborates further on the case study research method discussed in chapters 5 and 6. The main focus of the annexure is to present the inter-rater reliability results for both the researcher and research assistant.

Annexure C presents the final list of variables adopted for this thesis based on the findings of the case study research conducted in chapter 6.

Annexure D augments chapter 8 by providing more detail on the prototyping of the conceptual model. The core focus is to present the implementation results for ten test case scenarios, predominately in the format of overall crime network diagrams and crime reports.

1.6   Conclusion

Organised crime has evolved into one of the most lethal and significant threats to societies, governments, businesses and individuals in the twenty-first century (Barker, 2017, p.1; Murray, 2013, p.107) and is therefore extremely high on the agendas of many governments world-wide. In fact, some venerable authors on this phenomenon claim that the importance of organised crime in many political agendas is only surpassed by the war on terror (Clark, 2004, p.98). Von Lampe (2012) discovered that the allocation of law enforcement resources in the US and UK appears to be slowly shifting from terrorism back to organised crime activities, highlighting the exigency to address and counteract the phenomenon.

Notwithstanding the myriad of research and strategizing efforts by law enforcement and research communities, it appears that inadequate progress has been made to counteract the illegal activities; this assertion is strongly supported by the ever-increasing illegal profits obtained by the organised crime organisations. This situation has been exacerbated due to the lack of a suitable universal overarching framework and/or model and limited amount of detailed information on substantive cases. Moreover, many authors have accentuated the need to develop such a model, claiming that it could assist with the better understanding of the organised crime phenomenon and potentially allowing for the development of more effective counter measures (Alach, 2011, p56; Morrison, 2002, p.1). Hence, one of the objectives of this thesis is to develop a comprehensive universal overarching conceptual model for organised crime.

The subsequent chapter conducts an extensive literature review on organised crime in general and considers aspects, such as the history of organised crime, definition and classification for articulating the crime, modern counteractive measures adopted by law enforcement agencies, future challenges posted by the phenomenon and examination of relevant research projects.

Chapter 2

Organised Crime Networks

Organised Crime Networks

This chapter focuses on:

- Articulating organised crime in general;
- Describing contemporary research issues in the burgeoning field of organised crime; and
- Delineating a holistic taxonomy which can be used to investigate real organised crime cases.

2.1   Introduction

At the turn of the twenty-first century, organised crime has emerged as one of the most significant threats facing communities in Australia and world-wide (Clark, 2004, p.98; Lawler, 2010, p.2). Although this phenomenon has been eclipsed by the war on terror in political and law enforcement agendas since the aftermath of the 9/11 attack in the United States (US), the focus of law enforcement agencies is slowly shifting away from terrorism back to organised crime (von Lampe, 2012, p.179). The shift in focus is mainly due to the fact that governments around the world have realised the imminent risks and challenges posted by contemporary organised crime attacks to the social, political and economic well-being of states and international communities (Wright, 2006, p.1). Another palpable reason for the shift is that organised crime has stretched far beyond the traditional Italian mafia concept and the encompassing Russian, Asian, Balkan, Middle Eastern or African syndicates; it is now truly transnational with a number of embedded ethnic and/or social commonalities operating as loosely affiliated groups targeting specific crime markets (Finklea, 2010, p.1; Lawler, 2010, p.2).

Consequently, organised crime is a subject that has attracted increasing attention from policymakers, law enforcers and researchers during the last few decades, with much of the attention focusing on organised crime as a whole or identifying the key characteristics of specific organised crime groups (Wright, 2006, p.1; Alach, 2010, p.56). However, it appears that the heightened attention had made finite impact on combatting the illegal activities. Morrison (2002), von Lampe (2012) Leong (2016) argue that one of the main reasons for this undesired situation is due to the fact that a number of challenges had hindered the emergence of a cumulative body of knowledge and the development of coherent theoretical frameworks. Furthermore, Wright (2006) stated that policymakers and law enforcers require state of the art theoretical and practical frameworks or models that will foster some clarity about the diverse, lethal and sophisticated phenomenon. Such a framework is required to set organised crime into a theoretical context which will allow law enforcers and researchers to gain a better and profound understanding of the phenomenon before defining and implementing new innovated solutions. Conversely, before delineating such

framework, it is imperative to ascertain and collect background information on the topic of concern.

The purpose of this chapter, therefore, is to clarify some of the most important concepts related to organised crime in a meticulous way and to establish a classification system which can be used to investigate organised crime in the rest of this research project.

The chapter commences with a short summary of the history of organised crime, followed by a short description of the most important concepts related to the phenomenon. Next, the focus is shifted towards the investigative aspects of organised crime by summarising modern counteractive measures and core components of crime cases, thereafter articulating the challenges posted by future envisaged illegal activities applicable to organised crime. This is followed by a high-level examination of relevant research projects with the aim of highlighting the shortcomings of existing research projects. The chapter concludes with a discussion on existing taxonomies and their deficiencies, as well as the definition of a new holistic taxonomy.

2.2   The Evolution of Organised Crime

Contrary to common perceptions of many regarding organised crime, it is a well-documented fact that organised crime is not a modern phenomenon (Leong, 2016, p.1; Wright, 2006, p.102; Morrison, 2002, p.3). Instead, it has an illustrious long history which can be dated back as early as the seventeenth and eighteenth centuries (Tupman, 2015, pp.226-230; Scalia, 2010; Balsamo, 2006, p.373). The remainder of this section examines organised crime by means of a time-line and continental-based approach with the focus on comprehending and highlighting typical activities conducted by the perpetrators. Although organised crime can be found in all countries world-wide (Lawler, 2010, p.3), this section is briefly articulating the most noticeable examples. These include the Sicilian Mafia, Chinese Triad and Tong groups and the Japanese Yakuza group. The final part of this section is examining organised crime in the Australian context.

2.2.1   Organised Crime in Europe

Organised crime originated in the establishment of European states in the pre-modern era and often deeply involved monarchs and rulers (Tupman, 2015, pp.220-223; Wright, 2006, p.102). The English monarchs exemplify this trend, who regarded the activities of privateers and pirates as legitimate when they enhanced the political and financial goals of the British Empire (Wright, 2006, p.103). Furthermore, there are also well-documented examples that highlight how the rich, and those in positions of administrative power, were breaking the law to cheat, intimidate and steal from the general population and in particular from the poor (Wright, 2006, p.102).

However, the formation of modern nations in Europe, by the turn of the nineteenth century, has led to the curtailing of large-scale banditry, except in states or places where state authority remained feeble (Wright, 2006, p.103; Morrison, 2002, p.3). Conversely, as the French revolution created strong nation states, many criminal groups fled to regions, such as Balkans, Southern Italy and United States of America (USA). Two main criminal groups that

provided local protection services arose in Southern Italy namely, the Sicilian Mafia and the Neapolitan Comorra (Clark, 2004, p.101). These groups, also known as the Mafia, became an alternative to the state and law enforcement by means of managing the settlement of debts and enforcing contracts (Wright, 2006, p.103). One of the main characteristics underpinning these groups was the importance of the family. All business activities were conducted in a network of closely related families with the emphasis on respect, fear and affection. The most common activity of that era was the protection of lands and plots of absentee feudal landowners (Scalia, 2010, p292).

In the early part of the nineteenth century, the original business model of the organised crime groups has changed somewhat from a family-orientated model to a wider spread society of families that mediated between landowners and the masses (Wright, 2006, p.104). The overarching concept of the business model was based on the fact that the families (landowners) sought protection for their estates, whereas the labour classes sought protection against the landowners. Consequently, the Mafia leaders became judges in interpersonal conflicts and provided a source of order that was an alternative to the weakness of the Italian state (Clark, 2004, pp.101-102).

With the rise of Fascism during World War I in Italy and the increased police actions against organised crime groups, the Mafia was compelled to operate underground and focused on societies where trust was scarce and democracy was weak (Wright, 2006, p.104). During this period, the business model has evolved further to include any activity which was part of commercial transactions of that era.

After the 1970`s, the face of the Mafia has changed as many Mafia families have followed the trend of competing for wealth on a massive scale. Unlike the previous business models, the Mafia of this era became embroiled with international organisations, such as the Colombian cartels and Chinese organised crime groups. As a result, more and more Mafia groups comprise non-family criminals which took an active part in the criminal activities (Wright, 2006, p.105). According to Wright (2006), the effect of these changes was a shift from a traditional based network of organised crime groups to one that was more distinctively modern. The modern organised crime groups in Italy can be categorised as follows:

- A shift away from protection activity towards more diverse goals (e.g. infiltration of the wine and citrus industries, control of hospitals and soccer teams, and so forth);
- Horizontal financial integration ('gangster capitalism');
- Control of political/economic clients, not using them for mediation;
- Vertical integration by inclusion of extra familial members; and
- Violence used for tactical control, rather than for strategic coercion.

The relationship between the Mafia and the Italian state has deteriorated in the past three decades. This situation was mainly due to the introduction of an Anti-Mafia Commission, which was later superseded by other measures to control the Mafia. Some of these measures include, amongst others, special powers for police, power to use electronic surveillance and telephone tapping, seizure of Mafia assets and an American-style program

for the protection of witnesses (Wright, 2006, p.108). At present there is a continuous effort by law enforcement to contain and prevent Mafia activities in Italy and the rest of Europe. However, the greatest challenge facing the law enforcement agencies today is to reverse decades of belief in populations that the Mafia has a legitimate role in the society, insofar as replacing the State as provider of protection (Scalia, 2010; Balsamo, 2006).

2.2.2 Chinese Organised Crime

Chinese organised crime became evident during the extensive Chinese immigration into the USA during the mid-nineteenth to early twentieth centuries encouraged by the development of Chinese communities in many American cities (Wright, 2006, p.109). Organised crime existed in the USA before the massive immigration of the Chinese; in fact, it can be linked back to the colonisation of the USA (Morrison, 2002, p.3). Notwithstanding the history of organised crime in the USA, the Chinese communities created their own organised crime groups to protect them against attacks from other immigrant groups.

Chinese organised crime groups were also known as Tongs. During the late nineteenth century these groups were associated with activities such as gambling, opium dens (establishments where opium was sold and smoked) and prostitution (Wright, 2006, p.109). The Tongs has also become instrumental in the development of Chinese organised crime groups in San Francisco and other parts of California, and to such an extent that Chinatowns were developed in most of the major cities of the USA. Despite the massive growth of the groups, they continued to be criminal street gangs operating in ethnically defined organised Chinese communities (McIllwain, 1999), not based on traditional "Secret Societies", as was the case with the Italian Mafia and Triads.

The Triad groups originated in the Fujian province of China and were renowned in the martial secret society, ostensibly dedicated to resistance to the Manchu empire (Wright, 2006, p.110; Murray & Baogi, 1994). Initially they practised Kung Fu as a form of self-defence, but with time the power of the Triads transformed into corruption and wide-spread criminality. Triads, such as the Green Pang, controlled Shanghai in the 1930s and contributed significantly in the defeat of the communist trade unions. However, with the emerging of the communist in Shanghai as ruling party, these Triads had to abscond to Hong Kong (Wright, 2006, p.110).

Organised crime related to China has also become noticeable in Europe since the early 1970s (Pieke, 2004). Since the 1970s, more and more Chinese immigrated to Europe which accentuated the existence of the Chinese organised crime groups. These groups were actively involved in drug trafficking (e.g. Heroin), illegal human smuggling and the control of Chinese gaming establishments (Bolz, 2010, p.147). As a consequence, these groups have increasingly become the focus of attention for the police in countries, such as United Kingdom and Netherlands (Wright, 2006, p.112).

Notwithstanding the continuous law enforcement activities against the Chinese organised crime gangs in Hong Kong, United Kingdom, Netherlands, USA and other countries, the

gangs somehow manage to operate successfully in today's global environment. Wright (2006) suggests that it might be due to collaboration between different organised crime gangs, such as the Sicilian Mafia and Chinese gangs. The author also highlights that the structure of Chinese organised crime gangs might be another reason for their success, which follows a degree of organisation without high levels of central control. For this reason, the structure is more fragmented and complex compared to traditional organisational structures. Therefore, perhaps the best explanation for their continuous success can be found in the fact that they are now widely dispersed through many countries which make them highly resistant to control and law enforcement measures designed to deal with the more tightly defined traditional organisations (Wright, 2006, p.113; Pieke, 2004, pp.1-20).

2.2.3 Japanese Organised Crime

Organised crime activities in Japan can be traced back as early as the seventeenth century (Kaplan & Dubro, 2012, p.7). The main international organised crime group originated from that era is called the Yakuza group, also known as Boryokudan – 'the violent ones' (Wright, 2006, p.113). Initially, the leaders of the group operated as labour brokers, who supplied construction workers for the large public works programs. By the nineteenth century, the Yakuza group has expanded to all of the major cities of Japan by means of supplying construction workers to all sectors of the economy (Gragert, 1999, p.153).

During the mid-nineteenth century, the gambling bosses managed most of the hostels that provided accommodation to the labourers (Gragert, 1999, p.154). These hostels have also been used by other gambling customers and potential gang members for illegal activities. A common practice at that time was the deduction of a percentage of the labourer's wages by the labour broker in return for a job in the construction sector (Wright, 2006, p.115).

By the late-nineteenth century, the business model of the Yakuza had slightly changed in the sense that the group was not operating primarily as gamblers, but was also exercising protection over the prostitution, entertainment and construction milieu (Kaplan & Dubro, 2012, p.xx). Noticeable of this era are the actions of the Yakuza group which resemble that of the Sicilian Mafia and other similar organised crime groups (Wright, 2006, p.115).

The period after the Second World War was a very productive era for the Yakuza and other organised crime groups in Japan. The expanding black market has introduced new opportunities for these groups to provide food and illicit drugs. As the country rebuilt itself after the war, more opportunities in the entertainment industry, bars, restaurants and prostitution emerged (Kaplan & Dubro, 2012, p.xiii). As a consequence, the use of brutal violent methods has become common in the entertainment industry. Moreover, the gangs had managed to penetrate legitimate businesses to camouflage their illegal activities, resulting in low risk environment for the gangs to operate within (Kaplan & Dubro, 2012, p.xiii; Wright, 2006, p.115).

The structure of Yakuza has remained fairly constant and comprises a large number of fictive families. The hierarchy is encompassed by the Japanese household and the central

relationship is that of father-child or master-apprentice. As highlighted by Wright (2006), the formal hierarchy is comparable to that of a legitimate corporation or that in a highly effective military, i.e. general, senior officers, junior officers and troops. More importantly, it is similar to the formal rank structures of the American Cosa Nostra and Chinese Triads (Wright, 2006, p.115; Clark, 2004, pp.103-104).

Today, the Yakuza remains the main international organised crime group in Japan (Gragert, 1999, p.204) together with a large number of local motorcycle gangs, who are predominantly responsible for most of the organised crime activities domestically. The current activities of Yakuza include protection, drug trafficking, gambling, labour brokering, management of prostitution, loan-sharking, debt collection and drawing money from fake social clubs (Clark, 2004, p.103). The group has also been involved in political corruption and financial scandals in Japan in recent times. More noticeable, the Yakuza has been involved with the import of firearms to Japan from the USA, as well as the infiltration into legitimate business in the USA as a means to hide their illegal capital (Wright, 2006, p.116).

The Yakuza is currently under scrutiny of Japanese Law Enforcement agencies in order to curb and restrict their illegal activities. Although the group appears not to have as significant international impact as their counterparts in China, many law enforcement agencies continue to regard them as a serious threat (Wright, 2006, p.117).

2.2.4 Australian Organised Crime

Australia is a reasonably young nation compared to Europe, China and Japan and does not have a rich history of organised crime (Leiva & Bright, 2015, p.312). Furthermore, the scarcity of reputable published evidence contributes to the difficulty to access the true extent of organised crime in Australia (Leiva & Bright, 2015, p.312; Morrison, 2002, p.4). However, Morrison (2002) suggests that compared to the other regions discussed so far, Australia experiences limited organised crime activities and most of them came to prominence during the mid-twentieth century. The criminal activities referred to includes fraud, people smuggling, abalone poaching, illicit trade in drugs and diamonds smuggling.

According to Morrison (2002), the main reason for this situation is the fact that Indigenous and Torres Strait groups of Australia do not generally participate in any serious and violent group criminal activities. The author also suggests that certain immigrant groups in Australia had a well-documented history of organised crime activities, albeit that the political interference and corruption carried out by those has not been achieved on the same level as in the other discussed regions (Morrison, 2002, p.4).

For instance, according to Hall (1986) a small minority of Italian immigrants in Australia have been involved in the Mafia or similar societies. These societies have provided protection services, and in some cases, were involved in money laundering (Hall, 1986, p.1-16).

During the last few decades, Australia has acted vigorously against organised crime, in comparison to many other previously colonised countries, resulting in a stable nation with strong economy and well-developed legal system (Morrison, 2002, p.4). Hence, Australia

has built a strong economical and stable political environment which is not conducive for organised crime groups to foster their illegal criminal activities.

However, as stated by the former Chief Executive Officer of the Australian Crime Commission in 2010, the face of organised crime in Australia is now truly transnational with few embedded ethnic or social commonalities. Currently, organised crime groups are more independent and targeting specific crime markets, such as drug importation and money laundering (Leiva & Bright, 2015, pp.318-319). Although identity fraud is at present the fastest growing crime in Australia, other criminal activities related to organised crime include, among others, money laundering, cyber-crime and illicit drugs (Lawler, 2010, p.1-12).

The opportunities presented by globalisation, communications and technology have increased the opportunities and exacerbated the effects of organised crime in Australia during the last few decades (Leiva & Bright, 2015, p.313). Moreover, as with any evolutionary process, organised crime has and will change the way it operates as a function of technological, ecological and social changes. As stated by Lawler (2010), Australia will need to maintain an innovative capacity through research, training, recruitment of specialist and technological capabilities to control and restrict organised crime in the future.

As seen from this brief extraction of the history of organised crime, it has evolved tremendously into a global phenomenon during the last few centuries. Although organised crime does not impact Australia as severely as other countries, it is still at least a fifteen billion dollars business which includes six billion dollars being deposited in markets abroad (Lawler, 2010, p.4). The recent appalling accusation against the Commonwealth Bank to fail to report properly on $77m worth of suspicious transactions related to breaches of money laundering and counter-terrorism-financing laws, serves as a timely reminder that Australia is not immune from organised crime. Therefore, there is an ever increasing need to participate in global debates on organised crime and to research new innovative ways to counteract the phenomenon. The next section articulates organised crime in general.

2.3   Organised Crime Concepts in General

The evolution and pervasiveness of organised crime have resulted in a continuous focus on risks and challenges posted by the phenomenon to the social, political and economic well-being of states and international communities. In order to systematically investigate and comprehend the risks and challenges, a basic background on the most important concepts of organised crime is required. This section commences with an investigation into various definitions of organised crime, followed by a short discussion on a typical representation of the phenomenon. Thereafter a short explanation of the different categories of organised criminal behaviour, organised crime groups, and models of organised crime are articulated. The final part of this section focuses on general characteristics of organised crime and transnational crime.

2.3.1 Definitions of Organised Crime

For many decades now, there is a healthy debate between crime investigators/criminologists and researchers/students as to what is an appropriate definition for organised crime (Lyman & Potter, 2004, p.4). In most cases, the description of organised crime varies according to the needs and experiences of investigative or research organisations (Morrison, 2002, p.1). For example, the FBI defines organised crime as:

"Any group having some manner of a formalised structure and whose primary objective is to obtain money through illegal activities. Such groups maintain their position through the use of actual or threatened violence, corrupt public officials, graft, or extortion, and generally have a significant impact on the people in their locales, region, or the country as a whole" (FBI, 2011).

Some researchers, such as Cressey (1969), define organised crime as:

"The organised criminal, by definition, occupies a position in a social system, an 'organisation' which has been rationally designed to maximise profits by performing illegal services and providing legally forbidden products demanded by the broader society within which he/she lives." (Cressey, 1969, p.72, cited in Wright, 2006, p. 4).

The main difference between the two schools of thought is that the investigative authorities are focusing on activities or enterprises of the criminals, whereas researchers mainly exert analytical approaches focusing on structures and familial relationships. The United Nations (UN) provides a definition that summarises both schools of thought by characterising organised crime as:

"… a group organisation to commit crime; hierarchical links or personal relationships which permit leaders to control the group: violence, intimidation and corruption used to earn profits or control territories or markets; laundering of illicit proceeds both in furtherance of criminal activity and to infiltrate the legitimate economy; the potential for expansion into any new activities and beyond national borders; and cooperation with other organised transnational criminal groups." (Reynold & McKee, 2010, p.1-2).

As highlighted by above definitions, there is only limited agreement between crime investigators/criminologists and researchers/students in terms of a suitable definition for organised crime. Nonetheless, above definitions emphasize, as with the case of other non-quoted definitions, the group nature of organised crime, the organisation of its members and the use of violence and corruption to achieve goals. Moreover, Wright (2006) expands further on the concept of organised crime by suggesting that the phenomenon is clandestine and polymorphous; it may occur in many forms at different times and in different places. Lyman & Potter (2004) agree with these attributes, but added that organised crime have a hierarchical structure, limited or exclusive membership and is governed by explicit rules and regulations.

On the contrary, a number of empirical studies conducted in the US, which are referred to as disorganised crime theory, have revealed that not all organised crime groups follow organisational structures that resemble traditional legitimate businesses, public sector

enterprises or a military hierarchy (Wright, 2006, p14.) They pointed out that some groups exhibited lack of centralised control, absence of formal lines of communication and fragmented organisational structures. However, the studies did confirm the fact that most organised crime groups exercise violence on occasions and aimed to maximising their profits (Wright, 2006, p17). The remainder of this section will continue to elaborate more on these attributes.

2.3.2   Representation of Organised Crime

Due to the fluidness of above definitions, Morrison (2002) argues that these definitions are not adequately suited to assist law enforcers to deal with organised crime from both an operational and policy perspective. The author offers three main reasons for this undesired situation, viz.:

- The lack of systematic reviewing and updating of the status quo of organised crime, by taking account of emerging forms of criminal enterprises;
- The changing perceptions of the motivations or activities of groups; and
- The slow unearthing of knowledge and understanding about the phenomenon gained through research and intelligence analysis.

Subsequently, Morrison (2002) proposes a framework for defining and understanding organised crime based on the representation of the inter-related aspects for both the current environment, as well as for the future. Figure 2.1 depicts the representation of the inter-related aspects of organised crime.

This framework articulates the different sets of initiating circumstances, the range of characteristics and actions of organised crime groups, and the various impacts experienced by communities. Hence, in order to prevent the impact of organised crime, law enforcers should concentrate on both the sociological/social-psychological characteristics of groups with the focus on society, relationships and group behaviour, as well as processes followed by organised crime groups.
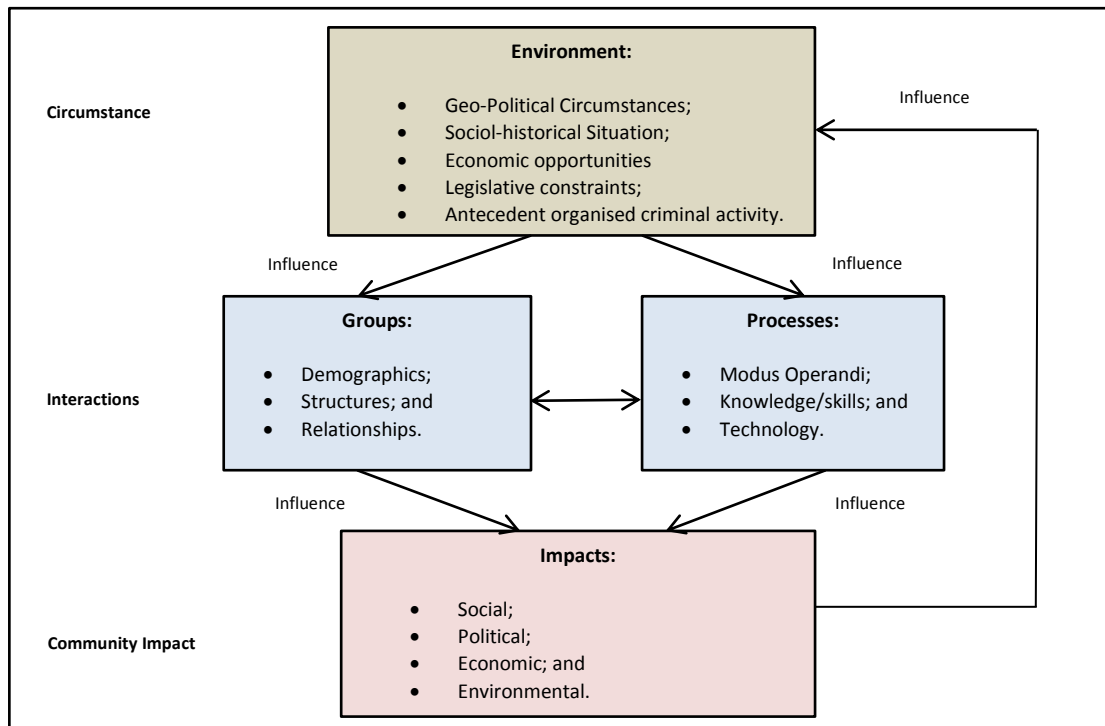
Figure 2.1: Representation of Interrelated Aspects of Organised Crime [Adopted from: (Morrison, 2002)].

2.3.3 Categories of Organised Crime

Morrison (2002) highlights that the results of applying the criminal processes within the society can range from basic crime activities to more complex transnational activities (Leong, 2016; Lawler, 2010). The activities can broadly be classified as crime against businesses, crime against individuals or crime against governments (Tupman, 2015, pp.223-225; Lavorgna & Sergi, 2013, pp.1-17). Organised crime organisations often victimise businesses through the use of extortion or theft and fraud activities, such as hijacking cargo trucks, counterfeiting products, robbing goods and committing bankruptcy fraud (Dobovsek & Slak, 2015, p.308). Organised crime groups also victimise individuals through activities, such as car theft, identity theft and credit card fraud (Dobovsek & Slak, 2015, p.308). Some organised crime groups defraud national, state and/or local governments through activities like producing counterfeiting money, manufacturing untaxed alcohol and providing illegal immigrant workers to marketplace to avoid taxes (Dobovsek, 2006, pp.1-10). A plethora of scrupulous research on each classification has been conducted for many years, such as the United Nations Office research on drugs and crime (Tupman, 2015, p.222), which has revealed that each of these activities could further be classified under several categories of organised criminal behaviour.

Lyman & Potter (2004) elaborate on these activities by defining six general categories of organised criminal behaviour. A profound understanding of these categories is required to comprehend criminal theories and to investigate organised crime. (More importantly, the

explanation of these categories is used as baseline for investigating substantive organised crime cases in future chapters.) Therefore, the categories are as follows:

- Provision of Illicit Services

  Illicit services refer to those services that are not provided by legitimate businesses or by law. Examples of illicit services include, among others, gambling operations that act outside the law, protection rackets, loansharking which is based on lending money illegally at usurious rates, and prostitution. These services are normally pursued to further the goals of the organisation.

- Provision of Illicit Goods

  Provision of illicit goods means goods that are provided by criminal organisations on the black market. The most noticeable and in demand illicit good is illegal drugs. Illicit drugs include among other, marijuana, cocaine and heroin, which provide billions of tax-free dollars to organised crime syndicates. Another illicit good in high demand is pornography.

- Conspiracy to Commit Crimes

  This category mainly refers to an agreement between two or more people to violate the law. In terms of organised crime networks, it is mainly pertaining to the heads of the criminal group. In most cases, the crime is committed by the workers or soldiers on the ground with approval from the heads or masters. As a consequence, these heads or masters who authorise criminal acts are guilty of conspiring to commit these acts.

- Penetration of Legitimate Business

  Legal businesses are penetrated by organised crime networks to cover illicit revenues and to obtain a legitimate face in the community to avoid suspicious citizens and police.

- Extortion

  Extortion is a form of theft and is defined as the use or threatened use of violence or force to achieve a criminal goal. From an organised crime perspective, extortion is mainly being associated with loansharking and the threat of violence against those who fail to repay debts on a timely basis.

- Corruption

  Corruption is one of the most powerful tools available to organised crime networks to maximise their profits and minimise the risk. The networks normally infiltrate law enforcement and public sectors to build corrupt relationships. Public and private figures normally targeted include law enforcement officers, judges, prosecutors, mayors, bankers, attorneys, accountants and political leaders.

2.3.4 Organised Crime Groups

The Australian Crime Commission (ACC) is Australia's national crime intelligence agency with the sole purpose of supporting the law enforcement agencies to reduce the threat and impact of serious and organised crime (ACC, 2016). They investigate and scrutinise organised crime by classifying the groups of criminals involved in this form of criminality as, criminal syndicates, outlaw motor cycle gangs and professional facilitators (ACC, 2016).

Criminal Syndicates

The term, criminal syndicates, refers to criminals who have a low visibility, but yet a massive impact on national and international economies. Most of these syndicates are based on decentralised organisational structures, resulting in sparse deployment around the world (Lyman & Potter, 2004, p.316). The ACC estimates that approximately seventy (70) per cent of all organised crime threats in Australia are based abroad (ACC, 2016).

The syndicates are primarily driven by financial prosperity and they are engaged in a diverse range of criminal activities such as, dealing with illicit drugs, credit card fraud, money laundering, prostitution, illegal gambling and so forth (Kleemans, 2014, p.1; Lusty, 2003, p.210); each activity is conducted across many sectors of the economy and at all levels of society (ACC, 2016). This group of organised crime perpetrators is highly successful and poses a real threat to Australia, particularly due to their dynamic nature and ability to adapt fast to changes in the environment.

Some of the characteristics associated with this group are:

- Transnational connections;
- Expansion across multiple crime markets;
- Financial crimes;
- Intermingling of legitimate and criminal enterprises;
- Use of new technologies;
- Use of specialist advice and professional facilitators; and
- The ability to withstand law enforcement interventions.

Outlaw Motor Cycle Gangs

Motor cycle clubs can generally be segregated into conventional clubs or deviant clubs. The majority of deviant clubs are those known as one (1) per cent or outlaw motor cycle gangs (OMCGs). The big four OMCGs are the Hells Angels motor cycle gang, the Outlaws motor cycle gang, the Bandidos motor cycle gang, and the Pagans motor cycle gang. All four of these gangs are renowned for their criminal activity and violence toward each other (Quinn and Koch, 2003, p.283-301).

Most of the OMCGs have an active presence in all Australian States and Territories. Although most of the Australian OMCGs are at present focused on the domestic front, there is an ever increasing tendency to interact with their counterparts around the world. More importantly, the ACC has revealed that the number of clubs and memberships pertaining to OMCGs are increasing on an annual basis, consequently

increasing the threat and impact of serious and organised crime in Australia. According to the ACC latest assessment, there are currently more than 40 OMCGs operating in Australia with about 6000 patched members (ACC, 2016).

Professional Facilitators

Professional facilitators are industrial professionals and service providers that exert specialist knowledge and expertise to exploit legal loopholes, ascertain opportunities for criminals, or assist criminals in retaining and legitimising proceeds of crime (ACC, 2015). These facilitators are often used due to a lack of knowledge and skills or to keep a barrier between the criminals and authorities.

Typical tasks involving facilitators are:

- Laundering money;
- Manipulating import processes at borders;
- Transporting and storing illicit goods;
- Assisting with technical components in manufacturing illicit drugs;
- Reaching and communicating with intended victims of fraud;
- Providing access to communication facilities, such as phone, fax or email so criminal groups can communicate with each other using the facilitator's business as a 'shield';
- Assisting criminals to avoid detection when laundering money by adding legitimacy to financial transactions;
- Providing clandestine accommodation for human trafficking victims; and
- Using computer technology to enable identity fraud (The New Zealand Government, 2011, pp.73-84; van Duyne et al., 2006, pp.28 -56).

Alach (2011) and Lyman & Potter (2004) largely implemented a similar classification system as above, but also included street gangs as part of their classification of organised crime groups. The authors argue that street gangs are a relative new emerging group which play a significant role in organised crime activities in countries such as the US and New Zealand. Moreover, although street gangs are not very prominent in Australia, considerable attention is paid to them by police agencies world-wide (Lyman & Potter, 2004, p.276; Alach, 2011, p.58). For this reason, many researchers suggest that they should be included in a crime typology that identifies and describes organised crime groups.

The researchers further suggest that most street gangs are less sophisticated and hierarchical than the other traditional organised crime groups (Lyman & Potter, 2004, p.274). They also argue that street gangs are "Loosely knit and poorly organised groups that engage in cafeteria style crime". The structure of the gang depends on the size of its membership, extent of its illegal activities and location.

Furthermore, traditionally street gang members range in age from 8 to 25 years old and they could be classified according to their level of involvement (Sanchez-Jankowski, 2003). In general, there are three types of street gang members, namely:

- Leaders;
- Hard-core members; and
- Fringe or marginal members.

Hard-core members are mostly feared by the communities as they are normally responsible for most of the violence and have committed most of the serious crimes. For this reason, most law enforcement efforts are generally directed at the leaders and hard-core members (Lyman & Potter, 2004, p.275).

2.3.5   Models of Organised Crime

During the last few decades, a number of models were developed with the aim to assist researchers and law enforcement officers to analyse and comprehend organised crime. Although there are many models available, three of the most common models used are called the Contingency model, Cosa Nostra model and Enterprise model (Lyman & Potter, 2004, p.39-44; Southerland & Potter, 1993).

Contingency Model:

This model was developed as part of a US President's Commission on Organised Crime (PCOC) between 1983 and 1986 (Lyman & Potter, 2004, p.39). The mandate of the commission was to analyse the nature and extent of organised crime in the US and then to develop strategies and recommendation which could be implemented by the US government to counteract and combat the phenomenon. In the final report, a model depicting organised crime has been proposed that provided insight into the hierarchy and physical structure of organised crime organisations.

The model outlines a number of levels of involvement pertaining to members and non-members of a typical organised crime organisation. These levels comprise, among others, the core criminal group, the protectors, specialised support, user support and social support. Figure 2.2 pictures the model with the four levels.
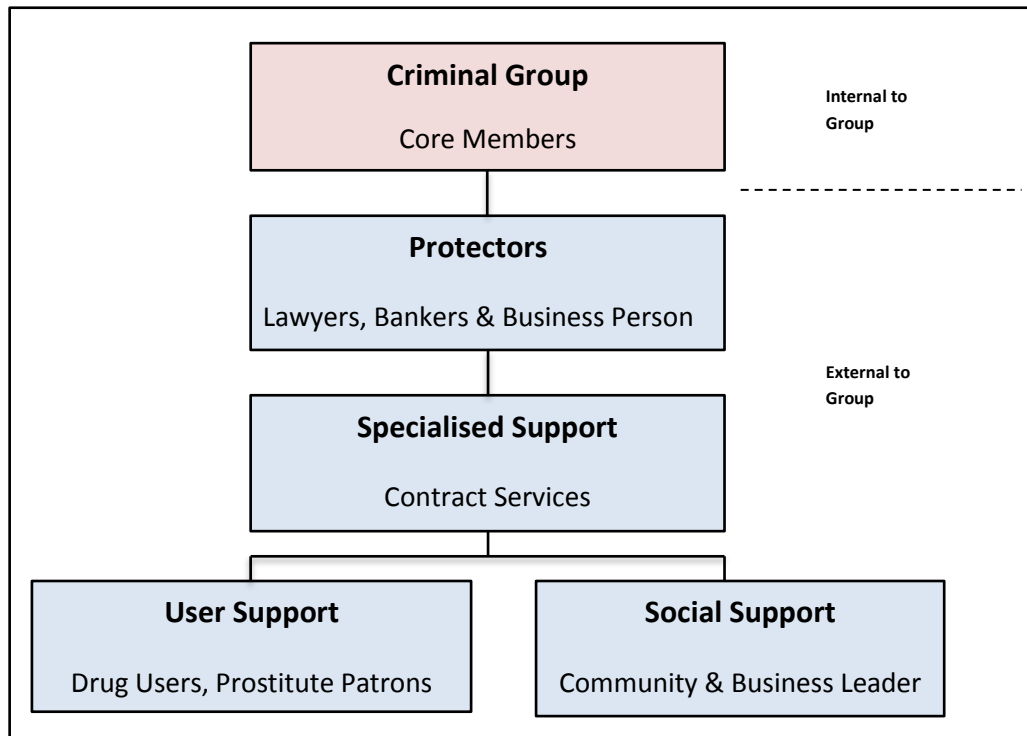
Figure 2.2: Organised Crime Contingency Model [Adopted from: (Lyman & Potter, 2004)].

The Criminal Group

Central to this model is the criminal group which consists of two or more persons who exert criminality and violence to gain influence and increase profit. The group is based on three important characteristics, namely Continuity, Structure and Membership. Continuity refers to the longevity of the group and in most cases it will operate beyond the lifetimes of individual members. The structure relates to the hierarchical arrangement of functions and tasks in the group. It is important to note that the structure could be either highly structured or immensely fluid, based on the activity or crime committed by the group. The membership of the group is based on common traits, such as ethnicity, race, criminal background or common interest (Lyman & Potter, 2004, p.40).

The Protectors

The protectors are individuals who abuse their authority and rights to protect the interest of organised crime groups. The relationship between the protectors and criminal group is heavily based on corruption whereby the protectors protecting the criminal groups from the criminal justice system in return for financial compensation. According to Lyman & Potter (2004), some examples of such protectors include corrupt public officials, business persons, judges, attorneys, financial advisors.

Specialised Supporters

These are highly skilled persons who normally do not share the goals and objectives of the organised crime group. The services provided serve as an important tool for the organised crime groups to achieve their objectives and include typically persons, such as pilots, chemists, arsonist, hijackers and computer hackers (Lyman & Potter, 2004, p.42).

The User Supporters

The user supporter refers generally to persons who purchase the illegal goods and services, such as drug users, patrons of bookmakers and prostitution rings.

The Social Supporters

These are normally persons who are not directly involved with the organised crime group, but are rather socially committed to the group. The social supporters seek the support of the members of the group in turn for creating a perception that the organised crime group is operating above board. Lyman & Potter (2004) exemplifies politicians as social supporters who invite organised crime members to social gatherings to gain their support.

Cosa Nostra Model:

The Cosa Nostra Model was developed by Cressey in 1969 after studying the Italian Mafia in the US (Cressey, 1969). This model had important influence on the US government policies on organised crime and is widely studied by criminologists (Wright, 2006, p.5; Moreslli, 2003). Cressey articulated organised crime in terms of a bureaucratic structure based on family values and norms. The author suggests that most organised crime networks follow a strong hierarchal structure that facilitates the flow of power and expectations of members. The hierarchy includes the boss, the consigliere, the underboss, the caporegime and the soldiers (Wright, 2013, p.4). Figure 2.3 portrays the model graphically.

The Boss

The boss is the typical head of a bureaucratic agency or governmental department that oversees all organisational endeavours. The boss endorses all decisions regarding major activities of the family business.

The Consigliere

The consigliere, or counsellor, can be associated with a business unit head in a government department, who has considerable influence on organisational endeavours. In many cases, the consigliere will be a lawyer who serves the boss as a trusted advisor.

The Underboss

The underboss is representative of the deputy head of the agency or department and will act on behalf of the boss during his/her absences. According to Lyman &

Potter (2004), underbosses are well respected and trusted by the boss and relay instructions to those members in lower positions in the family.

Bureaucratic Hierarchal Structure:

```
                                    Boss
                                            
                                                    Consigliere
                                
                                Underboss
                                
Caporegime   Caporegime   Caporegime   Caporegime   Caporegime

                                Soldiers
```
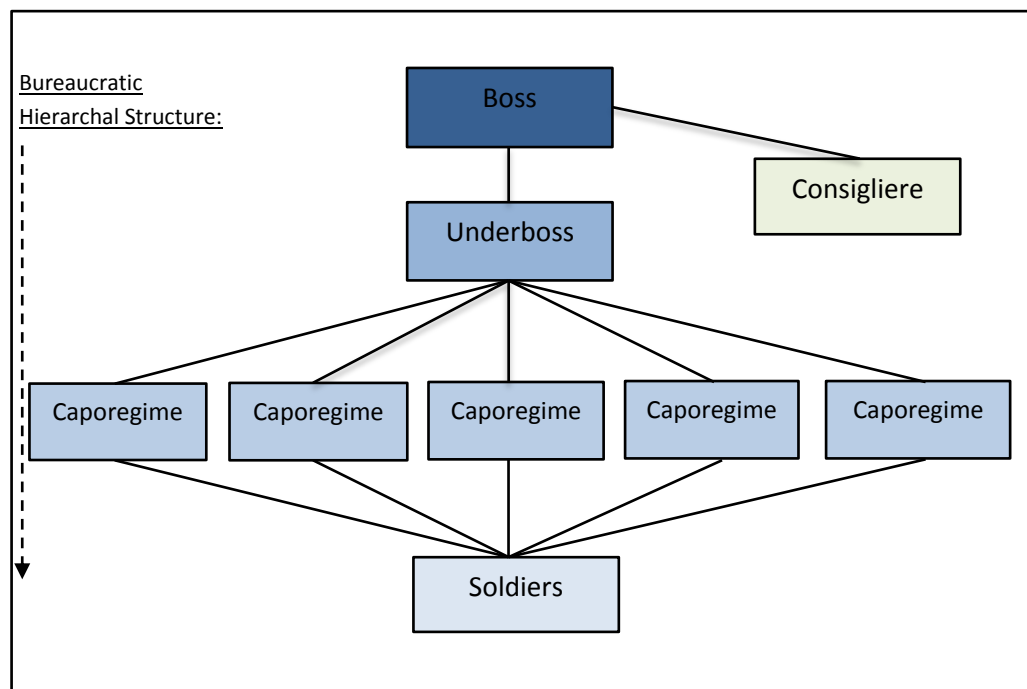
Figure 2.3: Cosa Nostra Model: Traditional Crime Structure [Adopted from: (Lyman & Potter, 2004)].

The Caporegime

The caporegime is typical mid-level managers in the governmental department or agency. Their prime role in an organised crime network is to serve as a buffer between the lowest-level members and the upper-level members of the network. All communication to and from the lowest members are channelled through the caporegime in order to protect the underboss and boss.

The Soldiers

The soldiers are the workers in the organised crime network and are dedicated to one specific criminal enterprise, such as loansharking or drug trafficking. In many cases, soldiers are responsible to pay a percentage of their profits to the organised crime network to ensure affiliation to that organisation.

Enterprise Model:

The enterprise model was first introduced by Smith in 1974 in his book called, The Mafia Mystique (Smith, 1975; Liddick, 1999; Lyman & Potter, 2004, p.48). Smith argues that organised crime is merely an extension of normal business operation into illegal markets. The model comprises three main components, namely legitimate businesses, non-legitimate businesses and customers. The model is underpinned by

entrepreneurship to maintain and extend market share and profit (Liddick, 1999). According to Lyman & Potter (2004), illegal activities, such as drug trafficking and loansharking, have emerged due to a large number of unserved customers by legitimate businesses. Consequently, in order to control and mitigate organised crime, law enforcement should not focus primarily on organisational leaders or notorious individuals, but rather on comprehending organisational behaviour in the illegal markets.

Moreover, at the heart of the model is the law of supply and demand. Most organised crime organisations seek high-level demand markets for a particular form of goods and services, combined with a relatively low level of risk and high profit margins (Edwards & Gill, 2002, p.218). A certain rate of consumption is required to maintain profits and any competition is discouraged at all cost. For this reason, many organised crime enterprises employ the use of violence, intimidation, corruption and extortion to expand markets and increase revenues (Gottschalk, 2010, p.296).

2.3.6 General Characteristics of Organised Crime

The processes and goals of organised crime networks persuade offenders to be covert and conduct their businesses in secrecy (Demiroz, 2012, p.272). Raab and Milward (2003) use the phrase, 'dark networks' when referring to covert and illegal networks. The covertness of an organisation is strongly related to its structure and the structure is shaped by organisational goals and the need for covertness and safety (Demiroz, 2012, p.273). Ericsson (1981) and Morrison (2002) have also argued that the environment, in which the criminal activity is conducted, is another determinant of the structure of criminal networks. Ericsson (1981) emphasizes that the structure of secret organisations has to be examined within its specific environmental context. For example, in high risk environments secret organisations prefer secrecy over efficiency and goal attainment.

Morselli et al. (2007) note that time concerns are highly influential to the efficiency-safety dilemma of criminal networks. The author argues that organised crime organisations which are motivated by monetary gains would prefer efficiency over secrecy, because time wasting will result in a decrease in the gains. This situation may command such criminal organisations to create a core within their network. On the other hand, criminal organisations, such as terrorist groups, who do not focus solely on monetary gains, usually wait for the right time before taking actions. As a consequence, they prefer remaining covert in order to be protected from crime counter measurements and generally have sparse networks (Morselli et al. 2007).

In addition, secrecy within organised crime networks operates at several levels. Identities, aims and activities may all, or some, be secret, with different consequences and risks to the individual and the network as a whole. The consequences of exposure will, of course, vary even with these simplistic parameters; for example, being found having an affair will likely have drastically different results compared to being identified as a Mafia informer.

Organised crime organisations could apply one or more of the general categories as listed in section 2.3.3, in order to achieve their objectives. For example, the commissioning of violent crime may form part of a group's toolbox to be used to achieve criminological goals, such as threatening victims, coercive measures to rough up victims and terror-inducing measures to intensify social and cultural conflict (Reynold & McKee, 2010, p.2). On the other hand, the same organised crime organisation may be involved in financial crime, and generate large amounts of money by activities, such as drug trafficking, arms, smuggling and financial crime (Schneider, 2010).

2.3.7   Transnational Organised Crime

At the turn of the twenty-first century, a new term called transnational organised crime has been developed to meticulously describe the pervasive activities of organised crime groups which relate to collaboration and cooperation of groups to facilitate the delivery of illicit goods and services on an international scale (Edwards & Gill, 2004, pp.1-3; Lyman & Potter, 2004, p.316). The globalisation of commerce and communications, free trade development in economies, evolutional changes in world politics and the liberation of the social world have all contributed to the new occurrence and the need to create a new term (Lyman & Potter, 2004, p.317; Wright, 2006, p.156).

According to von Lampe (2012), the concept of transnational organised crime is ambiguous and vague, similar to the concept of organised crime. The ambiguousness is mainly due to the ambiguity of the term 'organised'. As highlighted by von Lampe, the criminal activities could be committed by unrelated individuals in two different countries, transnationally mobile offenders or large, closely-related criminal networks located in many different countries.

Notwithstanding the ambiguousness, it is important to highlight that transnational organised crime is not a new form of organised crime, but rather an extension of traditional organised crime. Evidence of this statement can be seen by analysing the definition of transnational organised crime as provided by the United Nations. The definition as quoted by Bell & Congram (2014) is as follows:

"Structured groups of three or more persons acting together, over a period of time, with the aim of committing one or more serious crimes committed in more than one State, or has significant effect on another State, or elements of planning, preparation, direction or control occur in another State" (United Nations, 2000, pp.25 – 26).

Therefore, the same definitions used before to describe organised crime (see section 2.3.1) is still valid with the exception that the crime is now committed across national borders. Furthermore, as pointed out by Lyman & Potter (2004), transnational organised crime has not been masterminded by the heads of organised crime syndicates; they still operate as before the internationalisation of organised crime. Albeit, in some cases, locally operated organised crime units are now taking advantage of modern advances in international trade

and technologies and are rapidly adapting to the new emergent international markets. For instance, with the advent of the internet and inception of online merchandising, some organised crime syndicates now employ professional spammers to acquire important information from local and international victims, previously obtained through physical theft. As highlighted by Hayati & Potdar (2008), professional spammers are capable of spamming most businesses and ordinary users to, among others, steal important information, such as credit card details, personal details, passwords and so forth.

Hence, the basic concept of organised crime has not changed much, even with the inception of the term transnational organised crime; it is still based on the system of patron-client relations which operates within the context of illicit entrepreneurship and is facilitated by the business people, law enforcement officials and politicians of the crime networks (Lyman & Potter, 2004, p.317). However, transnational organised crime has resulted in more collaboration and cooperation between law enforcement agencies world-wide. As suggested by Lawler (2010), law enforcers are now in a greater need to build international intelligence on organised crime cases, as it is spreading across the globe.

To summarise, organised crime is a complex subject, and no single definition could be found to adequately explain the phenomenon. The challenge to define organised crime is both semantic and empirical. Wright (2006) argues that it is semantic in the sense that the phenomenon is contestable, with no complete agreement about what the term means. It is also empirical in the sense that there is no absolute consensus about substantive examples which is fully applicable to the term.

Nonetheless, recent research has highlighted firstly the gradual increment of the crime and secondly the fact that the main characteristics that underpin the phenomenon remained fairly constant, i.e. collaboration of two or more offenders, pursuit of profits and/or power and so forth. Hence, the author of this thesis has the contention that although the definition of organised crime phenomenon is contestable, law enforcement and researchers continue to identify and prosecute organised crime offenders successfully by means of existing definitions; the existing definitions therefore appear to be fit for purpose for the current criminal environment. Further to that, the existing definitions are enabling researchers to focus on long-established organised crime groups and the control of these groups over certain territories or economic sectors (e.g. protection, racketeering and so forth); it also allows for investigation of the complex transnational illegal activities, such as drug trafficking, human trafficking, or fraud, as well as permitting researchers to scrutinise local illegal markets, such as local drug dealing or gambling.

Therefore, although no consensus does exist, it is recommended for the purpose of comprehending organised crime that the definition of the UN is employed (as outlined in section 2.3.1). The rest of this section has also elaborated on a number of general concepts related to organised crime, which ensure a common framework of understanding for the rest of this thesis. Next, these concepts are further articulated by presenting background on the investigation of organised crime from a holistic and general perspective.

2.4   Organised Crime Investigation and Counteract

As highlighted in the previous section, organised crime is a very diverse and complex subject, committed by all societal levels in the community and on all continents. As it poses a serious threat to individuals, businesses and states, most if not all governments are continuously seeking ways and means to contain and control organised crime. This section focuses on current investigative actions exerted against organised crime activities and commences with a brief introductory discussion on strategies aiming to curb and restrain the phenomenon. This is followed by a brief articulation of work conducted by law enforcement agencies in tackling the phenomenon, and concludes with a discussion on how the international community co-operates to combat organised crime.

2.4.1   Regulatory Strategies

As with the case of most risk management strategies, current organised crime strategies are aiming to respond to the actual threats and challenges posted by the phenomenon. Leong (2016), Dobovsek (2006) and Wright (2006) elaborate on these strategies and argue that they should predominantly focus on social, economic and political domains within which it operates.

In terms of the social domain, Dobovsek (2006) and Wright (2006) highlight the importance of accurately identifying and dealing with the social context and key relationships which are imperative for the growth of the criminal network. Examples of relationships to be comprehended and taken account of in any strategy should include familial ties and, ethnical and geographical origins. Subsequently, governments concerned with organised crime should consider the prevailing social conditions in formulating any police or strategy to deal with the phenomenon.

In relation to the political domain, Wright (2006) strongly suggests that strategies should focus on prevention of corrupting public officials, judges and legislators, as well as making enough resources available to deal with the phenomenon vigorously and swiftly. As alluded to by Lyman & Potter (2004), the success of many organised crime organisations is dependent on a corrupted relationship with their protectors. Therefore, strategies should focus on anti-corruption measures that correct the worst effects in the political domain.

With respect to the economic domain, many experts of organised crime advocate that governments should adopt regulatory strategies to minimise the effect of fraud and other malpractices (Wright, 2006, p186; Dobovsek, 2006, p.5). Moreover, regulatory strategies and domestic legislation should consider the enterprise model of organised crime, in particularly recognising the important role played by legitimate business in organised crime activities.

Hence, strategies to combat organised crime should therefore take into account each and all of these domains: social, political and economic. Also, the strategies should consider the enterprise model which comprises legitimate businesses and crime networks, as well as the patron-client relationships (Kleemans et al., 2010, pp.3-4). Wright (2006) concludes that

well formalised and implemented strategies alone will not deal with organised crime; criminal investigation and other law enforcement activities are also important.

2.4.2   Law Enforcement: National and International Co-operation

In addition to strategies which are used to control and mitigate organised crime activities, investigation and law enforcement should also play important roles in bringing offenders to justice. Law enforcement combats organised crime on three levels, namely proactive intelligence strategies, bilateral co-operation between states and countries, and multilateral co-operation in law enforcement (Leong, 2016; Newburn et al., 2012; Dobovsek, 2006; Wright, 2006).

At the first level, law enforcement combats organised crime at both local and international level by implementing proactive intelligence strategies. These strategies include, among others, proactive policing, making use of surveillance methods, informants and other intelligent gathering techniques, 'supergrasses' and 'sting' operations, and so forth (Dobovsek, 2006, p.4; Wright, 2006, p.188).

Police agencies also implement technical strategies to combat organised crime. Most of these strategies involve the use of specialised resources in an integrated intelligence system (Wright, 2006, p.188). Many of these systems are based on intelligence analysis software and specialised electronic resources, aiming to map the associations between actors, events and activities in a criminal network. These software tools allow the police agencies to get a better understanding of organised crime networks and to identify vulnerabilities. The HiTS/ISAC problem-solving environment for interoperability and situation awareness is one such example where a range of software tools enables law enforcement to analyse and visualise organised crime groups and activities (Ferrera et al., 2008).

Although these software packages become more prevalent, Wright (2006) pointed out that there is still a reluctance to make use of these tools, most probably due to the ambiguousness and complex nature of the phenomenon. Indicative of this fact is that many police agencies across Australia and the world have special business units that implement these proactive and technical strategies (Palmer, 2000, pp.5-10).

At the second level, law enforcement combats organised crime by means of bilateral co-operation between countries and states. In most cases, bilateral co-operation is normally in the form of technical assistance and intelligence support for operations (Wright, 2006, p.189). For instance, Germany has agreed to provide co-operation to combat organised crime in Europe, especially Eastern and Central Europe. The USA also provides a level of bilateral co-operation to other countries, such as Hungary, Colombia and so forth. The co-operation is in the form of operational support, as well as intelligence and resources.

The final level of law enforcement is multilateral co-operation between law enforcement around the world (Palmer, 2000, p.2000). For example, the Schengen agreement set out measures to improve co-operation between police, customs and judicial authorities in the

European Union (Hert & Vandamme, 2004, pp.425-434; Wright, 2006, pp.189-199). The agreement also includes technical measures, such as an information system that provides information about individuals, lost or stolen property and criminal matters (Hert & Vandamme, 2004, pp.425-434). Another example of multilateral co-operation is the introduction of Europol and Interpol. The main aim is to co-ordinate the efforts of European and other countries in the fight against crime, such as organised crime (Hert & Vandamme, 2004, pp.425-434; Wright, 2006, pp.189-199). These international police agencies investigate, among other things, illicit drug activities, illegal immigration networks, sexual exploitation of women and children, terrorism, money laundering and counterfeiting.

Notwithstanding the success of all three levels of crime combating endeavours, it is important to illuminate two important limitations applicable to law enforcement while dealing with organised crime. Firstly, as highlighted by Wright (2006), in many cases the law enforcement agencies have limited control over what they can exercise. There are legal, jurisdictional and political limitations that restrict investigative agencies in their investigations. Secondly, in some cases it is problematic to implement high level strategic measures with the reality of law enforcement on the ground. For these reasons, Wright (2006) and other authors argue that organised crime should first and foremost be combated at local level and that the best possible direct and technical measures be made available to local enforcement to act against organised crime.

2.4.3   International Conventions

Organised crime is a truly international wicked problem that also requires crime control policies on a national and international level to deal with it. The three most common international conventions dealing with organised crime are:

- The 2000 UN Convention against Transnational Organised Crime (Standing, 2010, p.1);
- The Treaty of Amsterdam (Pollack, 1999, pp.1-20); and
- G8 recommendations against Organised Crime (Scherrer, 2006, pp.1-13).

The UN General Assembly adopted a convention against Transnational Organised Crime in November 2000. The convention addresses two main goals: Firstly, it eliminates the effects of differences between national legal systems, which have blocked mutual assistance in the past. Secondly, it provides set standards for domestic laws so that law enforcers can act effectively against organised crime. Under this convention, signatured governments had committed themselves to the following actions:

- Criminalising offences committed by organised crime groups, including corruption and corporate or company offences;
- Cracking-down on money laundering and the proceeds of crime;
- Speeding up and widening the reach against criminal groups;
- Protecting witnesses testifying against criminal groups;
- Tightening co-operation to seek out and prosecute suspects;
- Boosting prevention of organised crime at the national and international levels; and

- Developing a series of protocols containing measures to combat specific acts of transnational organised crime (United Nations, 2000).

Most countries world-wide had ratified the convention and it clearly provides their respective authorities with the necessary political and legal framework for international action against organised crime.

The Treaty of Amsterdam is another example of a convention that aims to improve co-operation amongst law enforcement agencies in terms of organised crime (Moravcsik & Nicolaidis, 1999, pp.59-85). The treaty came into effect in 1999 and includes strategies that allow police and customs to work together, as well as co-operation on criminal law (Wright, 2006, p.194). Overall, the treaty provides a vehicle for law enforcement to control, regulate and prevent organised crime within the European Union.

Within the European Union, there is a greater emphasis on preventing organised crime. Importantly, an ever-increasing amount of strategies focus on prevention, which are based on two core elements, namely:

- Prevention or reduction of particular forms of serious crime (thus focus on harmful acts); and
- Reduction in the growth and development of organised criminal groups or formations and in their involvement in the commission of those serious offences (thus focus on harmful actors) (Wright, 2006, p.195).

Heads of states and governments of the major industrial democracies have also realised the knock-on effect of organised crime in terms of the political and economic fronts. This has urged world leaders to address the subject in their annual G8 meetings since 1995 (Wright, 2006, p.198). The leaders had set up a group of senior experts to review and evaluate international agreements and to make recommendations on how to combat organised crime effectively. The group has so far made a number of recommendations, which include strategies and guidelines on how countries can best work together (Masciandara, 2004, pp.1-29). The group continues to evaluate trends in organised crime and have focused recently on mutual legal assistance and extradition, firearms control, top end technology used in organised crime, international financial crime and tax evasion.

This section elaborated on how governments deal with organised crime from a local, national and international perspective. It is quite clear that most law enforcement agencies make use of both regulatory strategies and technical measures to tackle specific cases and to bring offenders to justice. This method of procedure provides a short-term solution to the problem, as most organised crime groups are polymorphous and versatile. Long-term solutions should, as a minimum, also include international co-operation. A number of international conventions and recommendations have been highlighted in this section. Whether the sum total of the regulatory strategies, technical measures and international co-operation is sufficient to be successful against organised crime, remains an open question. The next section will further investigate organised crime by describing the core components of a substantive organised crime case.

2.5   Core Components of Organised Crime Cases

The preceded section highlighted how governments and law institutions deal with the complex organised crime phenomenon from a holistic perspective. In order to get more insight into the criminal phenomenon, the focus is now shifting towards low level detail pertaining to the phenomenon, and in particular to the core components that make up organised crime cases. Criminologists who conduct comprehensive research in crime cases focus on, among other things, Modus Operandi (Bartol & Bartol, 2014 p.295), Judicial Decision Making and Sentencing (White & Perrone, 2010). In a nutshell, the explication of modus operandi summarises the main actions and behaviour of the alleged offenders in the case for the researcher, whereas the outcome of the judicial decision-making process highlights the contraventions in terms of the related legal act, and the penalties confirm the level of involvement of each offender. Based on this basic description, the remainder of this section will further describe the critical components.

2.5.1   Modus Operandi

As highlighted by Bennell & Canter (2002), the term modus operandi is utilized ambiguously by police officers, crime fiction writers and researchers. For this reason, Bartol & Bartol (2014) provides a high-level overarching definition for studying modus operandi from a criminological perspective. They state that "modus operandi refers to the actions and procedures an offender engages in to commit a crime successfully" (Bartol & Bartol, 2014, p.295). They elaborate further by highlighting the actions and procedures relate to the behavioural patterns that offenders learn over a period of time, as they gain experience in committing the various offences. In general, the behavioural pattern of offenders changes as the offender/s learn/s the trade of offending; thereafter it normally becomes more stable and static with time (Bartol & Bartol, 2014, pp.294-298).

Furthermore, some criminological theories proclaim that the environmental settings and personal traits (signature aspects) of perpetrators have a significant impact on the modus operandi of committed crimes (Dobovsek & Slak, 2015, p.308; Douglas & Douglas, 2006, p.19). For example, robberies committed in specific regions are normally similar in modus operandi and motives. Dobovsek & Slak (2015) and Bennell & Canter (2002) further emphasize that there is typically a high degree of similarity in actions and procedures in terms of what offenders do to commit a particular offense category. For instance, various research studies on modus operandi of murders, robbers, thieves and burglars have revealed reasonable similarity in actions and procedures for each offense types (Daniels et al., 2016, p38; Atta-Asamoah, 2009; Copes & Vieraitis, 2009; Douglas & Douglas, 2006, p.19-30).

In terms of methods, a literature review on offender modus operandi in general has highlighted that the methods used by criminals may vary from crime category to crime category (Daniels et al., 2016, p38). Violent crimes, such as homicide and robbery are more prone to encompass violence and/or threats compared to non-violent crimes, such as property crimes. For example, serial commercial robbers often engage in violence to subdue

the victims and to ensure easy escape capabilities, whereas property crime most often targets unoccupied properties to commit their crimes (Douglas & Douglas, 2006, p.20).

Bennell & Canter (2002) and Bartol & Bartol (2014) highlight another important characteristic of modus operandi, namely time span of event. For certain offense types, the time period for committing the crime might be relatively short, whereas for others it might take months or even years. Notwithstanding this variance, the actions and procedures for most offense types can be conceptualised as an event that unfolds over time, ranging from pre-event, execution event and post event activities (Munasinghe, 2014, p.265).

Daniels et al. (2016) have conducted an extensive research on captive-taking of victims and could serve as baseline to shed light on general abduction activities conducted by organised crime offenders in their quest to maximise their profits. The study involves the unlawful abduction or holding of another person against his or her will. Eight convicted offenders participated in the research, who were charged for crimes extending from murder to engagement in organised crime. The researchers have interviewed the eight offenders and identified the core behaviours and actions followed by each offender. Each of the behaviours and actions were linked to three phases of the crime event, i.e. pre-event, execution event and post event phases.

Regarding the pre-event phase, the researchers discovered that most offenders concentrated on planning and preparing actions. In most cases, these actions were executed over a long-term, which included making plans or preparing for the actual events. Some of the tasks that are conducted during this phase encompass gathering of information, group involvement (direction provided within group) and incident planning.

In relation to the execution event phase, i.e. the capture and holding of the victim, the researcher learned several common actions across most of the cases. Some of the actions listed for this phase were crime specific, resulting that the findings might not be applicable to other offence types. Notwithstanding this, it was discovered that most offenders barricaded themselves, interacted with authorities and focussed on efforts to minimise evidence.

Finally, in terms of the post event phase, the study has revealed that several common actions were listed that extended from the moment the captive-taking event ended until weeks or even years later. The common actions range from efforts to evade the law enforcement and surrendering, to apprehending of offenders after a period of time.

2.5.2 Judicial Decision-Making

White and Perrone (2010) define judicial decision making as the determination of guilt or innocence of an accused person (i.e. conviction) as well as the determination of an appropriate sentence in the case of a guilty verdict; hence, it can be summarised as the administration of the law. Tumonis (2012) asserts that there are two grand theories of judging which are implemented by the legal profession to make judicial decisions – legal realism and legal formalism. The author highlights that the core difference between the two

sets of theories relates to the importance of legal rules in making the judgement. In terms of formalism, judging is a rule-bound activity only and the judge is seen as the operator of the legal rule system. Legal realists to the contrary are far less rule-bound and more discretionary-based in relation to judgement.

The discretionary aspects of the legal system can be summarised as the active and creative ways in which judges deal with criminal matters on a case-by-case basis, including determining guilt and sentencing (White & Perrone, 2010, p.409). White and Perrone (2010) argue that most convictions and sentencing embrace some form of discretion by legal persons within the criminal justice system, often resulting in non-rational, inconsistent, overly lenient or overly punitive judgement. This occurrence causes conflict with other legal pillars, such as formal equality and consistency of the rule of law, as well as defining mandatory procedures and rules, guideline judgments or decision-making frameworks.

Notwithstanding this dilemma, White and Perrone (2010) claim that by studying the judicial decision-making process on a case-by-case basis provides valuable profound insight and understanding related to each case. They argue that in order for a judge or jury to make a judicious decision, they need to consider all the facts of the case and publicise their understanding of the case in the court summary or other related document.

2.5.3 Sentencing Factors

The judicial decision-making process related to sentencing is heavily underpinned by sentencing factors. During the sentencing process, the main factors relevant to sentencing from the point of view of both the defence and prosecution are presented in an attempt to influence the obligation of one form of penalty over another (White & Perrone, 2010, p.426). In most cases, defence counsels will focus and accentuate mitigating factors to argue a more lenient penalty for their clients, whilst prosecutions will in general emphasize the existence of aggravating factors to secure harsher penalties. In determining the most suitable penalty for each unlawful act, the judge or jury weigh-up the aggravating factors against the mitigating factors.

By and large, it appears that the courts have not shown any intent to prescribe the factors relevant to sentencing, except for the Crimes Amendment Act 2002 (2002) (White & Perrone, 2010, p.426). However, White & Perrone (2010) listed a number of factors relevant to sentencing, which include inter alia the following:

- Offence gravity – The maximum or minimum penalty prescribed by the relevant act in the indictment.
- Offender involvement - Refer to the level of involvement, i.e. mastermind or naïve offender, as well as the motive for committing the crime.
- Character of the offender (prior criminal history or absence thereof).
- Age of the offender as a mitigating factor.
- Cooperation with authorities – could result in discount of sentence if information is provided about other suspects or circumstances of the criminal act.

- Remorse and plea – Both evidence of remorse toward victim/s and early guilty plea could lead to discount in sentence.

Organised crime from a micro level perspective was articulated in this section. The discussion focused on three general core components related to the investigation and prosecution of criminal offenders, i.e. modus operandi, judicial decision making and sentencing. Whilst the information on modus operandi provides intrinsic detail on criminal behaviour and actions, evidence on judicial decision making and sentencing provides valuable overall information on the most general aspects of the case. As a consequence, researchers could potentially analyse these core components to comprehend common criminal activities, chronological events, traditional crime indicators, and psychological and sociological aspects related to organised crime cases. The next section collates the knowledge obtained from the previous two sections and attempts to forecast the future of organised crime and possible trends.

2.6   The Future of Organised Crime

Lyman & Potter (2004) refer to the future of organised crime as highly ambiguous and highlight that the only predictable aspect that can be said about organised crime is the fact that it is extremely unpredictable. Lawler (2010) agrees with them and adds by stating that whatever proves to be highly successful against organised crime today will most probably become irrelevant or obsolete in the future. Both these statements highlight the importance of predicting the future drivers of organised crime to ensure that law enforcement officers can maintain an innovative capacity, resulting in successful combatting of organised crime. The rest of this section briefly articulates three possible future trends in organised crime.

2.6.1   Information Theft

In 2004, Lyman & Potter predicted that information theft will become the major practice for organised crime criminals to maximise their profits. They have based this statement on the fact that information has become immensely powerful, especially when used strategically. They also based their prediction on the proliferation of telecommunication networks and computer technologies.

Today, information theft is a reality and can be manifested in many different ways, such as financial theft, identity theft, credit card theft, card skimming, mortgage fraud, superannuation fraud, and so forth (ACC, 2016). Lynman & Potter (2004) have suggested that financial institutions will be the number one target for organised crime criminals, although the use of violence and intimidation will always be part of their toolbox. As more and more customers utilize on-line services, the higher the likelihood that financial institutions will become the target of organised crime organisations. These groups will attempt to ascertain information, such as, computer and account passwords, as well as

access codes which will allow criminals to infiltrate accounts without casting suspicion on their operations (Lynman & Potter, 2004, p.526).

In terms of Automated Teller Machine (ATM) card payment fraud, Sullivan (2010) has revealed that this form of information theft is nowadays ubiquitous in most countries around the world, such as US, Australia, Spain, France, UK and so forth. The information theft in this content relates predominately to the stealing of identity information applicable to the card holder. Subsequently, identity theft occurs when a criminal takes information about a person illegally, either by means of stealing, intercepting or by skimming the card, to create a new deceitful self-fabricated card, or non-deposit (cell phone, utility, and so on) account. It is well documented in the news media today that criminals can easily and readily install card readers onto legitimate card slots and cameras in hard-to-detect positions to obtain identity information such as PIN numbers (Sullian, 2010, p.3). Consequently, by applying the identity information of the person unlawfully would enable them to achieve their main object, i.e. maximising their profits.

Going forward, Lynman & Potter (2004) have predicted that organised crime organisations will increasingly employ highly skilled computer hackers. They also suggested that hackers will be tasked to alter bank records, credit card accounts and criminal reports. Other authors also suggested that hackers could be used to provide protection for organised crime bosses (Lynman & Potter, 2004, p527).

2.6.2   The Power of Legitimacy

According to Lynman & Potter (2004), another important envisaged goal for organised crime organisations in the twenty-first century is the process of legitimating illegal criminal activities. For instance, they highlight that many Colombian cartels have already invested heavily in the stock markets to launder the profits obtained through their organised crime activities. Moreover, they also pointed out that the main organised crime group in Japan, Yakuza, has also already invested in real estate holdings in all parts of the world and this trend might be followed by other organised crime groups.

However, some authors such as Allum & Siebert (2013) claim that the legitimation process could be intricate as the main aim is to minimise the risk of exposure, maximise the profits and create new market opportunities. The process might encompass the use or misuse of legitimate techniques of businesses and industries, which could often require assistance of high social status members of the society. Other venerable authors agree with Allum and Siebert and add by suggesting that organised crime organisations have long infiltrated large-scale industries, such as the restaurant business and garment industry to obtain a legitimate business front (Lynman & Potter, 2004, p527; Lawler, 2010, p.4). They also predict that many of these criminal organisations could in the future attempt to seize control in some of the world's largest multinational corporations, resulting in making it almost impossible to distinguish between legitimate and illegitimate businesses.

2.6.3   Utilization of Technology to Exploit On-line Systems

Electronically stored information has proliferated exponentially during the last decade (Choo & Smith, 2008, p.37). A study performed in 2003 has reported that about 92% of all data created during that time was created in electronic form, and in most cases it was stored on hard disks (Lyman and Varian, 2003). A further report in 2006 has indicated that the amount of digital information created, captured and replicated in 2006 was approximately 161 billion gigabytes (Choo & Smith, 2008, p.37). According to Vellante (2010), the amount of digital information in 2009 has grown to 800 billion gigabytes and the prediction is that it will continue to grow at a rapid pace. The adoption of cloud based storage and embracement of social media around the globe are a couple of reasons offered for the dramatic increment of electronic data (both for private and business data).

Simultaneously to the proliferation of stored information, the availability and reduction in cost of broadband connections, technological innovations and lower cost for storage devices have all contributed to the greater utilization of technology (NCA, 2016, p.16). These advancements have led to the introduction and continuous usage of on-line systems by the banking and financial industry, such as electronic payment systems and electronic clearing.

Notwithstanding these advancements to improve customer services and business operations, more and more organised criminals are exploiting the risks associated with on-line systems. Information and communications technologies (ICT) are increasingly being used by organised crime groups to infringe legal and regulatory controls by developing new crimes to take advantage of risks associated with on-line payment systems, on-line auctions, on-line gaming, on-line networking sites and blogs (Choo & Smith, 2008, p.39).

According to Choo & Smith (2008), an ever-increasing amount of proceedings of organised crime is placed into financial systems by purchasing electronic currency or digital precious metals (NCA, 2016, P.29). The aim of the criminals is to disguise the origins of the illicit proceeds by performing a series of business transactions, such as transferring electronic currency through a series of offshore companies and the purchase of goods for resales, prior to integrating the cleaned proceeds. One example of such electronic currency is Bitcoin. Bitcoin is a peer-to-peer payment system used for online transactions (Raeesi, 2015, p.5). According to Raeesi (2015), many criminal groups use Bitcoins to trade illicit drugs online, especially on the Dark Web.

Choo and Smith (2008) studied the money laundering process and highlight that more organised criminal groups are hiring money mules to execute the money laundering process. In certain cases, syndicates utilize ICT to set up websites that resemble Foreign Investment Advisory Service websites (NCA, 2016, pp.28-29). In other cases, more money mules are recruited to launder money originating from frauds committed in Australia by exerting remittance companies and telegraphic transfer. The recent allegations in the media against Commonwealth Bank of Australia for breaching money laundering laws after allowing thousands of large cash deposits to wash through its ATMs, is one practical example where criminal groups are using the legitimate banking sector to launder proceeds of crime.

Another popular online internet based service is online gaming. Online gaming allows players to compete with and against each other globally in real-time. To participate in this type of gaming requires players to exchange real money for virtual currency obtained from gaming sites or third-party trading websites. The virtual money is then used to purchase virtual properties, virtual accommodation and virtual merchandises (Hayes, 2008, p.1).

One of the main future risks associated with online gaming is that organised crime organisations will use the gaming sites to launder their profits obtained through illegal crime activities (Hayes, 2008, p.4). Another risk is that organised crime organisations might target the gaming sites to steal the usernames, passwords and credit card numbers of the gamers (Choo & Smith, 2008, p.49).

An additional online service currently been exploited by organised crime organisations is social networking. Social networking sites, such as Facebook, allow users to post personal information and photographs to friends and the wider community, as well as interacting with other users in real-time. Although the service is immensely popular, it also presents organised crime organisations with the opportunity to exploit the service, particularly by malware authors. Personal information obtained from these networking sites could be used to facilitate organised crime activities, such as identity theft and context-aware phishing (Choo $ Smith, 2008, p.51).

Organised crime is thus a reality for all levels of the society and will become a greater wicked challenge for law enforcement in the future, due to the sophistication of technology that enables organised activities (Standing, 2010, p.11; Gottschalk, 2010, p.1; Choo & Smith, 2008, p.54). These groups will continue to incite hatred, violence and intimidation, mainly through the internet, consequently presenting a real danger to the economic and social stability of the international community. Subsequently, these threats will increase the demand for new strategies, technical measures and international treaties (Standing, 2010, p.12). Some of the most important efforts to counteract the criminality are discussed next.

2.7   Relevant Research Projects

As previously highlighted, organised crime has manifested into a global epidemic which could have serious impact on the stability of the world economy (Kirby & Snow, 2016, p.111). Hence, a number of governments have tasked international researchers to conduct research on this topic and to propose alternative ways and means to counteract the wicked criminal activities. In recognition of these efforts, nine of the most noticeable and prominent international research endeavours are briefly articulated below. The focus of these research attempts extended from analysing the relationships among offenders within the various criminal structures, major activities conducted within the structures, criminal network dependencies, and high-level combating policies and strategies. Each of these research projects is articulated below with the aim of identifying a plausible research gap in the notorious field of organised crime.

2.7.1 Destabilising Terrorist Networks

The first of these research programs relevant to this thesis is called 'Destabilising Terrorist Networks'. This program focused on the differences in hierarchical organisations and cellular/distributed covert networks (Carley, 2003; Ressler, 2006, p.3). The researcher proposed a dynamic network analysis approach, which could be used to analyse larger terrorist and crime networks. This approach is based on connecting various entities, such as agents, knowledge and events with a weight and/or probability structure. The main outcome of the research program was to empower social network analysers to get a better understanding of the complexities of social behaviour (Gerdes, 2015, pp.214-222). However, one of the shortcomings of the program is the fact that the approach was not tested on large organisations with complex networks. There was also a concern regarding the flow of incorrect information and the relative impact of such information warfare (Carley, 2003).

2.7.2 Longitudinal Dynamic Network Analysis

Another relevant project is called 'Longitudinal Dynamic Network Analysis'. This project was conducted by McCulloh & Carley and focused on ways and means to quickly detect behavioural change in a covert network (McCulloh & Carley, 2009). This evidence is then used to make some inference about the actual time of change. The researcher proposed a new approach, which can implement the inference about the actual time of change, and called it Social Network Change Detection (SNCD). The purpose of the approach is to offer the executives and military analysts a tool to allow them to identify a possible attack/crisis just before it happen. For example, this approach could allow a military social analyst to identify a possible terrorist attack, such as the 9/11 attack, as early as possible. Additional change detection procedures are currently being investigated to improve the performance of the SNCD software tool (McCulloh & Carley, 2009; Gerdes, 2015, pp.214-222).

2.7.3 Anatomy of Dark Networks: The Case of the Turkish Ergenekon Terrorist Organisation

One of the most relevant research projects applicable to this thesis is called 'Anatomy of Dark Networks: The Case of the Turkish Ergenekon Terrorist Organisation'. The researchers of the project highlighted that many similarities exist between terrorist networks and organised crime groups. With respect to similarities, they pointed out that the organisational structures, the structure of relationships between its members, and the need for covertness and safety of terrorist networks, resemble that of many organised crime groups. However, they have also highlighted a major dissimilarity, i.e. organisational goals - organised crime groups' core goal is to generate monetary gains, whereas terrorist groups strive for social and political disruption through sensational events (Demiroz, 2012, p.273).

The aim of the project was to analyse Turkey's Ergenekon Terrorist Organisation (ETO), which is a political conspiracy network that has played a significant role in the terrorist activities within the country during the last few decades. The project examined the structure of the ETO using network analysis tools and court documents as the primary data

source.   The data set for the project is based on one single court case, which encompasses three publicised court indictments.   Findings have indicated that the network has a concentrated structure which consists of a core and periphery group of actors. Centralisation within the network has been explained as elitist traditions in government and policy-making fields.

Another finding of the project has indicated that efficiency-security trade-off did not take place in the ETO network since the political and legal conditions of the country allow members of the network to act comfortably, as opposed to being under the threat of counter-terrorism or law enforcement efforts.   Two of the most important limitations of this project are firstly that the sample data used for making conclusions represents only a small portion of the ETO cases, and therefore the network structure might not be relevant to all the cases.   Secondly, most of the activities only focused on terrorist activities and not on organised crime, as such (Demiroz, 2012, p.291).   See section 3.7 for more information on the case.

2.7.4   Estimating the shape of Covert Networks

A further relevant research project relating to this research project is 'Estimating the shape of Covert Networks' (Dombroski, Fischbeck & Carley, 2003). This project commenced with a study on individuals, groups and relationships in the groups.   It then examined the possibilities of using the inherent structures observed in social networks to make predictions of network activities by using limited and missing information.   The researchers defined a model based on empirical network data exhibiting the structural properties of triad closure and adjacency.   Triad closure indicates that if person i has a dyad with person j and person j has a dyad with person k, then there is a high likelihood that person i and person k have a dyad (also called transitivity).   Also, adjacency is a corollary of triad closure stating that if person i has a dyad with person j, it is more than likely that person i has a dyad with person k (Dombroski, Fischbeck & Carley, 2003, p.2).   The model exploited these properties by using an inference model to update adjacent dyads given information on a reference dyad.

The model has been tested against several existing prediction models to understand and distinguish its behaviour.   In order to test the effectiveness of the model, the researchers utilize a data set of 20 network nodes, which were executed 20 times by the new and other comparative models (Dombroski, Fischbeck & Carley, 2003, p.6).   The outcome of the research project was that if the new model is built with careful consideration of important characteristics of the predicted network, it does provide assistance to analysts so that they could make better informed decisions.   However, the model performed relatively poorly if there was a disproportionate amount of information either supporting or not supporting a dyad and/or if dyadic priors are well informed.   The model has also been applied on covert network examples and has also been extended for epidemiological networks.   The significance of this project is that it provides a solid theoretical platform for developing new models intended to make network predictions, and then to use those predictions to make better decisions.

2.7.5 United Nations Office on Drugs and Crime

Many other accredited organisations are currently engaged with research projects related to the organised crime phenomenon. One such organisation is the United Nations Office on Drugs and Crime. The United Nations has completed a pilot survey on 40 well known organised criminal organisations/cases. This study describes the modern organised crime trends, as well as methods to successfully investigate the crimes (United Nations, 2014). The research programs of the United Nations generally focus on most of the activities of organised crime, but tend to treat the programs as individual stand-alone entities. Likewise, the programs also lack in operational detail.

2.7.6 Comprehensive Approach to Tackling Serious Organised Crime

The Comprehensive Approach to Tackling Serious Organised Crime research program is a government initiative that focuses on organised crime (Home Office UK, 2009). The UK government has embarked on an ongoing research program to understand the trend of organised crime, as well as to defining a strategy which will keep them 'one-step-ahead' of organised crime offenders. The strategy is based on an overarching approach which involves the whole-of-government, as well as partners from abroad. The outcome of the program is a high-level management framework on how to address organised crime effectively. The three key pillars of the framework are as follows:

- To reduce the profit incentive – limiting the opportunities for organised criminals to make money;
- To disrupt activities – using all means at the disposal of the authorities to disrupt criminal enterprises; and
- To increase the risk – targeting the major players in organised crime with more successful prosecutions.

The framework was validated by means of consultation with more than 50 high profile governmental and private organisations around the globe. In 2016, the UK government reassessed the effectiveness of the framework and establish that the UK authorities have disrupted 2137 organised crime cases in 2015, which could directly be related to the new framework implemented previously (NCA, 2016, p.9).

The researchers of the program do take all activities of organised crime into consideration, but deal with them from a policy and high-level management perspective. The operational aspect of the strategy, including the methodologies, tools, and so on, is not defined and is the responsibility of the relevant department that must exert the strategy. The significance of this program is the fact that the UK government acknowledges that organised crime is serious and complex and that it should ideally not be dealt with from a silo approach.

2.7.7 Australian Institute of Criminology

The Australian Institute of Criminology (AIC) is a local organisation that is actively conducting research on organised crime. The AIC has been a significant criminal justice publisher since the mid-1970s. Research projects cover a range of broad subject areas, such as arson, corporate crime and fraud, corrections, courts, crime prevention, cybercrime, drugs, organised/transnational crime, policing, property crime, sex crimes, social groups and crime, and violence. The AIC primarily investigates and focuses on each of the criminal activities as a separate silo and does not perform an overarching research on organised crime. The general outcome of these separate research projects is published to assist crime investigators and criminologists. Many papers are available from the AIC website and are also being used in the course of this research project (Australian Institute of Criminology, 2014).

2.7.8 The Dutch Organized Crime Monitor

The Dutch Organized Crime Monitor (DOCM) is an academic research group in the Netherlands with the core purpose of optimising the use of knowledge gained during large-scale investigations to develop an insight into the nature of organised crime in the Netherlands. The group was established in 1996 and is responsible to publicise progress reports on the nature of organised crime in the Netherlands every four to five years.

The main research question for the research project is: "What is the nature of Organized Crime in the Netherlands and which developments can be discerned in the field of Organized Crime?" (Kruisbergen, 2014). In order to answer the research question, the researchers investigated and analysed 150 organised crime cases since 1996, which represented a wide cross-section of various forms of organised crime. The cases include criminal activities, such as transnational drug trafficking, human smuggling, sex trafficking, arms trading, vehicle theft and large-scale fraud and money laundering.

As the law enforcement institutions in the Netherlands are more willing than their counterparts in other countries to participate in research projects (Kleemans, 2014(*a*), p.58), the researchers are granted access to investigation materials, such as transcripts of wiretaps, the data obtained from police observations and interrogations of victims and offenders, as well as interviewing the investigation officers for each case. The research methodology was based on qualitative research, focusing on describing and analysing the files by means of an extensive checklist which elaborates upon the following main questions:

- What is the composition of the group and how do offenders cooperate?
- What kinds of illegal activities do they engage in, and how do they operate?
- How do they interact with the opportunities and risks of their environment?
- What are the proceeds of the criminal activities and how do they spend these proceeds?

The major outcome of the research project to date is that the nature of organised crime in the Netherlands has and is still changing since the 1990s. Likewise, the criminal investigation strategies employed by the respective law enforcement agencies are also changing to counteract the phenomenon. The researchers proclaim that the research results are suggesting that organised crime groups should be viewed as criminal networks, resulting in more advanced prompt intervention investigative strategies (Kruisbergen, 2014, p.292). They proposed that the average period of investigation should range between six weeks to three months; the aim should be on disrupting the internal relationships in the network and gathering as much information as possible about the most important offenders in the network (Kruisbergen, 2014, p.292). A number of developments in the field of organised crime have also been emphasized. The research project is on-going and the next report is expected in 2018.

The main aim of establishing the research group is to provide empirical results related to the current status of organised crime in the Netherlands. The research project is built on a solid and rigorous platform and the results are subsequently used by policymakers to augment existing policies and strategies (Kleemans, 2014(*a*), p.59). However, hardly any focus in the research program is given to delineate and cultivate technical measures, such as new innovative operational models and analytical tools.

2.7.9   The Disruption of Organised Crime Groups

The final research project considered is that of two researchers from Lancashire, UK. The researchers investigated the effectiveness of a relative new and innovative approach implemented by an English Police Force in the north of England. The authors have argued that organised crime is a hidden, ambiguous and diverse phenomenon and as a result the current traditional approaches utilized by most law enforcement agencies around the world are focusing on prosecution and incarceration of specific organised crime criminals; these approaches are extremely expensive and sometimes ineffective (Kirby & Snow, 2016, p.112).

The new approach is called the disruption approach that has been defined as a flexible, transitory and dynamic tactic exerted to make the environment hostile for the organised crime group (Kirby & Penna, 2010, p.205). The approach focuses on disrupting the offender's networks, lifestyles and routines, thereby reducing the threat and the frequency of the crime. The purpose of the research was to examine the nature of the interventions used by the police.

The data set for this project encompasses 15 recent organised crime cases categorised as successfully disrupted. The researchers had to complete a comprehensive vetting process before they received the data set and were allowed to interview a number of analysts and practitioners for further information. The data set included, among others, personal descriptions, criminal convictions and sanction history. The primary research methodology was based on a qualitative research method which employed content analysis for analysing statements and qualifying the research variables. Further to that, a quantitative research

method was used to analyse numerical data for the purpose of measuring and interpreting the variables in questions.

The results of the study highlighted the fact that dealings with illicit drugs and money laundering were the two most common areas of criminality in the study. Furthermore, 40% of the offenders were classified as principle and significant members, which were targeted by the police. It was also revealed that the police used a number of intervention tactics which range from making the subjects aware that they are being targeted, to arresting principal and significant members for lower level offences.

The study, in general, has divulged that although the approach appears reasonably effective, it is surrounded by methodological concerns relating to the identification of organised crime and the measurement of the impact of the interventions. The study has also revealed that certain offenders have continued to offend, after deemed as no longer a threat to society; this undesirable situation has resulted in some researchers questioning the approach. Finally, although the research project did not focus explicitly on developing alternative organised crime investigation models or frameworks, it has contributed to the knowledge base of organised crime strategies and policies.

Table 2.1 summarises above research endeavours in terms of proposed methods to combat organised crime. Notwithstanding these efforts, many universities around the world acknowledged the need for further research on organised crime. The overarching consensus of these universities is that organised crime has become so complex and diversified that it is very challenging to research the phenomenon in a complete/holistic package. Therefore, most of these research programs focus either on strategies or technical measures to holistically counteract organised crime; in some cases, they also focus on one of the crime activities related to organised crime or on trends and traits of the phenomenon (Lavorgna & Sergi, 2013, p.1; Sergi, 2015, p.182).

Ref No.	Research Project	Study Description	Focus of Project	Shortcoming related to Organised Crime
1	Destabilizing Terrorist Networks *(Carley, 2003)*	Studying social groups to get a better understanding of relationships between actors and group behaviour.	Technical Measure	Focusing on one activity/criminality of Organised Crime only.
2	Longitudinal Dynamic Network Analysis *(McCulloh & Carley, 2009)*	Investigating ways and means to detect change in a covert network.	Technical Measure	Focusing on one activity/criminality of Organised Crime only.
3	Anatomy of Dark Network: The Case of the	Studying clandestine networks to discover network patterns which can be used to explain	Technical Measure	Focusing predominantly on terrorism.

	Turkish Ergenekon Terrorist Organisation *(Demiroz, 2012)*	future terrorist attack cases in Turkey.		
4	Estimating the shape of Covert Networks *(Dombroski, Fischbeck & Carley, 2003)*	Studying social networks to make predictions by using limited and missing information.	Technical Measure	Focusing only on the sociological aspect of organised crime.
5	United Nations Office on Drugs and Crime *(United Nations, 2014)*	Studying modern organised crime trends and investigation methodologies.	Strategies	Focusing on activities separately and lack operational detail.
6	A Comprehensive Approach to Tackling Serious Organised Crime – UK Government *(Home Office UK, 2009)*	Investigating current status of organised crime and defining a strategy which will keep law enforcers in the UK 'one-step-ahead' of organised crime offenders.	Strategies	Focusing predominantly on strategies and policies. Lack operational detail.
7	Australian Institute of Criminology *(Australian Institute of Criminology, 2014)*	Researching most (if not all) activities of organised crime by means of separate research projects. The focus is on organised crime trends and techniques.	Predominately Strategies	Focusing on activities in silos.
8	Dutch Organized Crime Monitor *(Kruisburgen, van de Bunt, Kleemans, On-going)*	Investigating the nature of organised crime in the Netherlands as well as which developments can be discerned by policymakers to supplement existing organised crime strategies.	Predominately Strategies	Focusing mostly on the research question related to strategies and policies. Lack operational detail.
9	The Disruption of Organized Crime	Examining the concept of disruption when tackling	Policies and Alternative	Focusing on alternative approach

Groups *(Kirby & Snow, 2016)*	organised crime. The study scrutinises the characteristics of the perpetrator, tactic used in applying the approach and re-offending levels.	Approaches	for combating organised crime and aim to contribute to the knowledge base of organised crime policies. The study lacks detail on technical measures.

Table 2.1: Summary of Relevant Projects to the Research Project.

2.8   Shortcomings of Existing Research on Organised Crime

While studying the research programs in the previous section, a number of reasons as to why these programs seem to miss the mark to assist law enforcement to combat organised crime more effectively, were noticed. First of all, the programs tend to focus on each activity of organised crime from an individual perspective and neglect any relationship between the activities. In practice, the contrary is discovered and in most cases the organised crime organisations diversify their criminal activities to maximise their profits and to minimise their risk (Lawler, 2010; Home Office UK, 2009). Likewise, in cases where organised crime is researched holistically, the focus is on strategy and policies and lack operational detail (Kleemans, 2014(*a*), p.57).

Secondly, most of the programs tend to lack detail regarding the modus operandi and logistics of offenders and the nature of offender structures. In-depth analyses on how exactly crimes are committed and how exactly the relations between offenders are shaped are the exception rather than the rule. Many commentators argue that not enough interview-based research programs are conducted on organised crime cases to extract more detail on the modus operandi of criminals. They also suggested that more focus should be on analysing data, including wiretap transcripts, generated in extensive criminal investigations (von Lampe, 2012).

The third shortcoming of certain research programs pertains to the constricted focus of the studies. The ETO research program is one example where the study only focused on a limited portion of the ETO case (Demiroz, 2012, p.291). The main reason for this adverse situation encountered in many academic research projects is the lack of relevant data from government agencies or the private sector (Kleemans, 2014(*a*), p.57). As a result, Kleemans (2014) asserts that many academic research programs fail to answer the questions raised by policymakers and criminal practitioners. From an academic perspective, this may not only lead to incorrect conclusions, but in certain cases it may prohibit the development of new, innovative frameworks and practical models.   Moreover, there is also a considerable difference in the scope and quality of data collected and processed by law enforcement agencies and certain private organisations. By and large, the data collected by law enforcement agencies is more comprehensive compared to private organisations. However, the general willingness of governments to cooperate with researchers may vary from state to state and country to country (von Lampe, 2012).

It is important to note that these shortcomings are mainly applicable to research programs conducted by private institutions, such as universities, not-for-profit organisations, and so forth (von Lampe, 2012). Based on the critique pertaining to these research programs (lack of focus and impact to counteract organised crime activities), it appears that the ultimate focus of future research programs in the burgeoning field of organised crime should be on exploiting both technical measures, as well as general findings and trends that supplement existing policies and strategies.

Therefore, against the background of existing research programs and the listed shortcomings, the remainder of this thesis focuses on a new research program that attempts to overcome or improve on most (if not all) of these shortcomings. In short, the aim is to develop a model which incorporates data sources from various technical measures that promotes the investigation of organised crime from a holistic view, and then to use the knowledge and findings to construct new frameworks which could augment existing organised crime strategies and policies in future research projects. Consequently, the emphasis is firstly to get an in-depth understanding of the intricacy of offenders' interactions and the nature of offender structures; and secondly to formulate a new model that could support law enforcers to counteract possible organised crime activities. The next section examines organised crime taxonomies in order to establish a basis for comprehending the actions, procedures, methods and structures associated with organised crime organisations.

2.9 Organised Crime Taxonomy

Klaus von Lampe, one of the leading contemporary experts on organised crime, highlighted the exigency to get a better and more in-depth understanding of the phenomenon (von Lampe, 2012). One method of obtaining such in-depth understanding is to scrutinise existing taxonomies of organised crime in order to select the best one or to create a new taxonomy based on existing literature (Alach, 2011, p.1). Most of the research efforts in this rapidly increasing field have either focused on defining the phenomenon holistically, or to identifying the key characteristics of specific organised crime groups and group functions; not too many researchers have concerted on defining taxonomies of organised crime (Alach, 2011, p.1).

Notwithstanding the lack of taxonomies, it remains imperative to identify and understand the main terminologies relating to taxonomies. The main terminologies include concepts, fundamentum divisionis, typologies and taxonomies (Marradi, 1990). In terms of classification, a concept is a main or general notion or idea of an area of concern, which is also known as a genus concept. Each genus concept can be extended into several lower general concepts called species concepts. Species concepts can be classified as either class or type sub concepts. Objects or events are assigned to classes or types on a one-to-one relationship, consequently each object or event can only belong to one class or type. The classificatory principle for species concepts is largely known as fundamentum divisionis or the basis of division. The predominant criterion for selecting a fundamentum divisions is to maximise homogeneity within classes or types and heterogeneity between classes or types (Marradi, 1990, p.129).

To explain above terminologies in more detail, consider a simple example relating to the governance of a country or state. The main concept could be the political system of governance, the fundamentum divisionis could be the principle of legitimising governors and the classes might be: theocratic, autocratic, plutocratic and democratic. Another fundamentum divisionis could be the degree of autonomy of a state or country, which will result in classes, such as unitary, federal and confederal. Each of the classes would also be sub-divided in terms of objects or events related to the class. For instance, if accountability for responsible government is exerted as the fundamentum divisionis for defining the objects for the federal class, then political, ethical and organisational dimensions could be used to classify the federal class (Marradi, 1990, p.132).

Marradi (1990) highlights that there are two main types of classification schemes used in social sciences, namely, typologies and taxonomies (Alach, 2011, p.63). Typologies are typically produced when more than one fundamentum divisionis are simultaneously taken into account to classify a topic of concern. Furthermore, the order in which fundamenta divisionis are consider is irrelevant and have no bearing on the intellectual fact finding (Marradi, 1990, p.143).

To the contrary, a taxonomy is framed when several fundamenta divisionis are considered in succession, rather than simultaneously. The order in which fundamenta divisionis are considered is highly relevant, as the order of succession is an indication of which characteristics are seen to be more important (Marradi, 1990, p.146).

Although some researchers see them as synonymous, Alach (2011) argues that they are more valuable when their differences are emphasized. Succession is the key difference in the two types of classification schemes, consequently providing a profound understanding of the area of concern. For this reason, taxonomies are used as the vehicle to get a better and more in-depth understanding of organised crime.

As alluded to by Alach (2011), relatively little attention has been paid to developing a classification scheme for organised crime. However, two of the most important taxonomies defined to assist in examining the environment, structure and operations of organised crime and to explore how criminal organisations respond to opportunities are:

- A taxonomy of all economic activities; and
- An incipient taxonomy of organised crime.

2.9.1 Taxonomy of Economic Activities

One of the first attempts to classify organised crime took place in the late 1960s in the US. Many researchers of that era recognised the significance of economic features in criminal behaviour and focused their efforts on economic analyses of crime by considering illegal economic activities and the rationale of perpetrators to maximising their objectives (Becker, cited in Sullivan, 1973, p.140). During the late 1970s, Dwight Smith has become one of the leading researchers on this topic and suggested that crime and its various manifestations could be presented in taxonomy of economic activities, as illustrated by figure 2.4.

Smith's taxonomy of economic activities describes organised crime from an economical perspective. The genus is called the economic activity of crime and it was sub-divided into five species, which are all narrower extensions conforming to the main concept of economic

activities. For instance, the first fundamentum divisionis used to classify economic activities is to measure the activity against the prevailing laws of the US. Hence, the activities are classified as either legal or illegal actions. In brief, the taxonomy classifies organised crime as an ethnical illegal economic activity conducted by Italians in the US.

The major novelty of Smith's study was the comprehensive description of organised crime as the expression of illegal economic activities. Furthermore, the study brought the economical perspective of organised crime to prominence; by clearly arguing that these activities are performed by both legitimate and illegitimate businesses. Therefore, the concepts of crime and economy were articulated as inter-related terms which are executed by both criminals and legal capitalists for monetary gains. Moreover, Smith suggests that organised crime is a perennial reality due to the desire for groups of people to take advantage of economic opportunities in pursuit of their own wealth and power, regardless of whether or not these goals are achieved through criminal means (Smith, 1980, p.369).

Notwithstanding the contributions made by Smith, many researchers argue that he overstated the relevance of ethnicity in the taxonomy, as later research highlighted that ethnicity is no longer accurate, nor suitable for classifying the phenomenon (Alach, 2011, p.58). Alach (2011) also argues that ethnical labelling of organised crime groups may be regarded as pseudo-racism and cultural insensitive. For this reason, many researchers use this taxonomy with caution to comprehend and analyse organised crime.
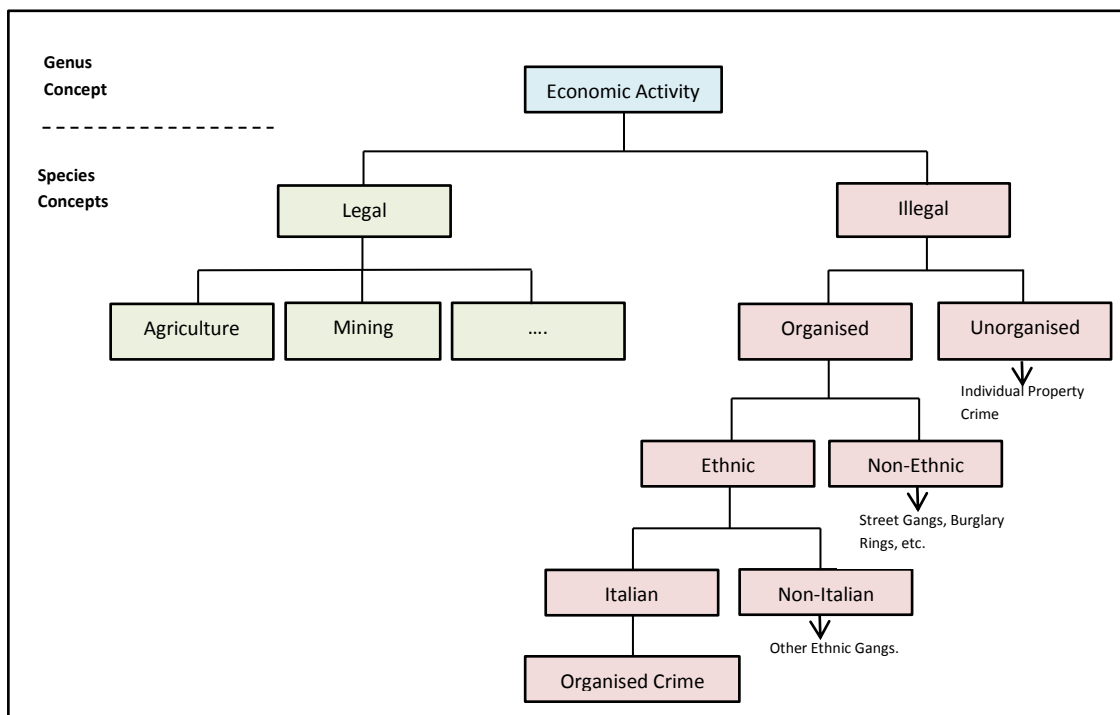
Figure 2.4: A Taxonomy of Economic Activities [Adopted from: (Smith, 1980, p.169)].

2.9.2 An Incipient Taxonomy of Organised Crime

One of the latest attempts to construct taxonomy of organised crime is called the incipient taxonomy by Alach (2011). Alach (2011) has recently embarked on a research project focusing on organised crime in New Zealand and has considered a number of typologies and taxonomies to analyse the challenges presented by the phenomenon. The author discovered the absence of suitable taxonomies and found that most typologies and taxonomies lack a comprehensive classification of organised crime as a whole. Furthermore, the author unearthed that the existing literature has a sizeable gap in relation to the classification of organised crime groups (Alach, 2011, p.56).

As a consequence, the author explores concepts from Weberian Sociology to segregate groups according to their primary motivator. Alach (2011) exerts Weber's four underlying principles for human social actions to classify criminal groups. The four social actions are as follows:

- Traditional Actions: This action is based on established customs; people act in a certain way due to 'built-in' habits. Thus, by doing things in a certain way will lead to certain actions.
- Affectual Actions: This action denotes human actions that are determined by the individual's emotions, feeling and affect; for example, striking someone in anger.
- Value-Rational Actions: This refers to human actions that are determined by a belief in a particular value. For instance, someone who performs an action for its own sake, without regard for consequences.
- Instrumentally-Rational Actions: This represents actions where the person considers the means, ends and consequences of his/her actions. Thus, when in acting, a person rationally assesses means in relation to ends.

Alach (2011) categorizes criminal groups in terms of above four philosophies by grouping them into three main groups. The author claims that the first group serve as carriers of community traditions and culture which is indicative of traditional or affectual principles. The second group focuses on status and cohesion, such as the mafia or outlaw motorcycle gangs. Hence, this group relates to the value-rational principle. The final group is motivated purely by profit and is mainly entrepreneurial orientated. This group therefore relates to the instrumental principle (Alach, 2011, p.66)

Subsequently, the author uses above description to delineating two typologies. The first typology involves a single fundamenta divisionis which classifies organised crime groups based on their motivation to perform certain actions. For the second typology, the author applied the taxonomy borough from von Lampe in conjunction with the first typology to define two fundamenta divisionis to classify organised crime groups (Alach, 2011, p.64). The first fundamentum divisionis encompasses motivation as the primary classificatory and the second fundamentum divisionis involves organisational structural as the primary divider. Both typologies are articulated in terms of Weber's four underlying principles for human social actions.

Alach (2011) exerted his second typology as the premise for the incipient taxonomy. The author converted each of the fundamentum divisionis into separate categories and

considered them successionally to derive the taxonomy. The main genus of the taxonomy is motivation; specie one is the structure of organised crime group and specie two is the functions performed by group members. The first fundamentum divisionis relates to motivation of group members to perform legal and illegal acts and the second divisionis refers to organisational types that influence members to commit organised crime activities.

As highlighted before, the sequence of succession of the fundamenta divisionis is an indicator of which concept or idea is the most important aspect of the taxonomy. For this taxonomy, the order of successional divisionis ranged from motivation to organisational types. Thus, the author claims that motivation is the most important aspect that incentivises gang members to take part in organised crime activities. However, he also admits that the order of the divisionis can be altered based on future empirical research (Alach, 2011, p.70). Figure 2.5 depicts the taxonomy.
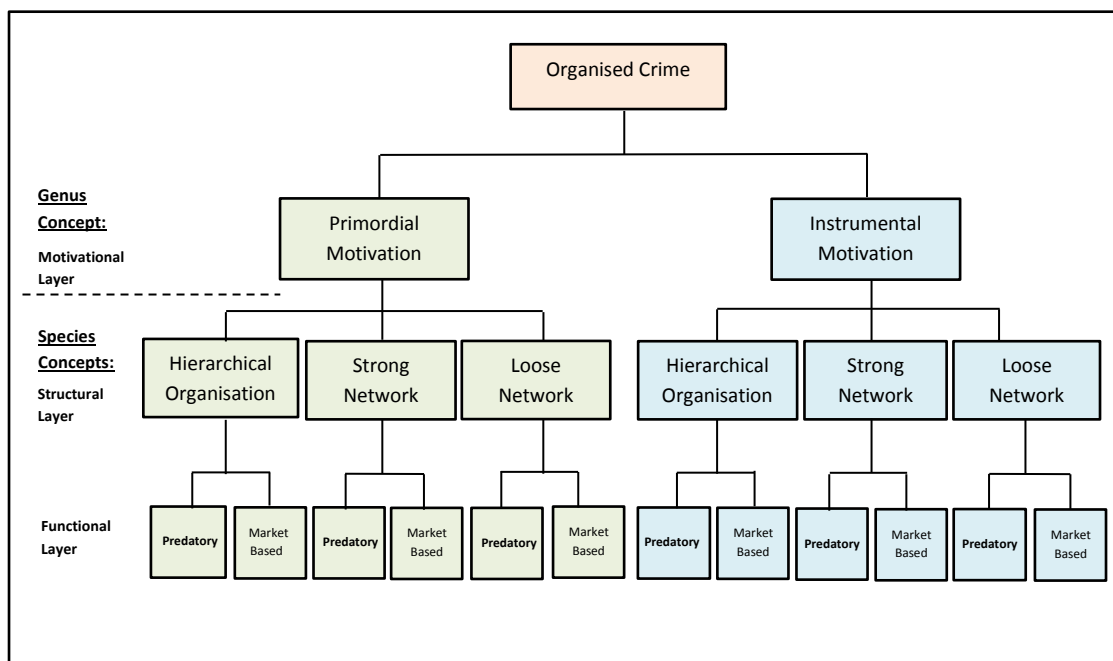
Figure 2.5: An Incipient Taxonomy of Organised Crime [Adopted from: (Alach, 2011, p.70)].

In conclusion, this section has scrutinised two well-known organised crime taxonomies, namely taxonomy of economic activities and an incipient taxonomy of organised crime. The first taxonomy focused on the economic activities of the phenomenon and illuminated that organised crime organisations resemble normal organisations that perform both legal and illegal activities. The second taxonomy focused predominantly on factors which motivate group members to conduct criminal activities. Although the economical perspective of the taxonomy of economic activities has made a contribution to get a better understanding of organised crime, many researchers have criticised it for the out of date classification of modern organised crime groups. To the contrary, the incipient taxonomy has addressed the deficiency of the taxonomy of economic activities by classifying organised crime according to Weberian sociology. However, the effectiveness of this new taxonomy has not yet been tested empirically.

Importantly, as alluded to by Alach (2011), a good all-inclusive taxonomy should encompass all aspects of the criminal environment, which is arguably not the case with the incipient taxonomy. The author also highlights the important fact that an effective taxonomy should be versatile and adaptable to investigate organised crime from a holistic perspective, as well as from an individual criminal activity perspective. Moreover, it should likewise be possible to apply the all-inclusive taxonomy to assist in developing better strategies and technical measures.

Finally, Akers (1999) argues that most common classifications of criminality should include, as a minimum, either sociological, social-psychological or biological variables, which are critical components when investigating criminality and deviant behaviour (Akers, 1999, p.4). The taxonomy of economic activities does take the cultural sociological variable into consideration, while the incipient taxonomy incorporates the structure of the organisation. However, an all-inclusive taxonomy should encompass all possible variables so that law enforcement could get a better understanding of organised crime and subsequently define more effective strategies and policies to countermeasure the phenomenon. An all-inclusive taxonomy, which comprises an extensive list of crime-related classes or concepts, is defined in the next section.

2.10   Holistic Taxonomy of Organised Crime

The previous section highlighted the fact that the incipient taxonomy seems to be the better taxonomy for understanding and combatting organised crime activities, on the other hand it also underlined that this taxonomy has at least one shortcoming. It does not include an extensive list of crime explanation classes or concepts pertaining to organised crime. As a result, this section is firstly drawing on literature articulated in this chapter to address the underlining shortcoming, and secondly it is proposing a new all-inclusive taxonomy which forms the core of the rest of this research project.

As highlighted in section 2.3, organised crime is an international phenomenon and therefore needs to be investigated holistically by means of an all-inclusive taxonomy. Before defining such taxonomy, it is important to comprehend the meaning of criminal investigative analysis. Bartol & Bartol (2014) define criminal investigative analysis as the process of identifying personality traits, behavioural patterns, geographic habits, cognitive tendencies and demographic features of unknown offenders based on characteristics of a particular crime (Bartol & Bartol, 2014, p.294). Most criminologists, law enforcers and scholars who apply criminal investigative analyses, study the legal definition of the crime of concern as outlined in the criminal code of that state or country and subsequently apply theories of criminal and deviant behaviour to identify the perpetrators and to gather conclusive evidence to convict such criminal or criminal group (Bartol & Bartol, 2014, pp.14 – 29)

Hence, to put together an overarching all-inclusive taxonomy, one should study the definition of organised crime and identify concepts and fundamenta divisionis which are based on one or more theories of criminal behaviour. In terms of defining organised crime, there are many definitions that articulate organised crime as outlined in sections 2.3.1 and 2.3.7. Many researchers, such as Bell &

Congram (2014), Conklin (2009), Abadinsky (2010) and Grennan & Britz (2006) share a similar definitional notion to describe the phenomenon. This generic definition is adopted to succinctly articulate the main concepts of organised crime for this taxonomy and further criminal investigative activities in future chapters of this thesis. The generic definition is as follows:

> "*Criminal activity by an enduring structure or organisation developed and devoted primarily to the pursuit of profits through illegal means…organised crime has the characteristics of a formal organisation: a division of labour, coordination of activities through rules and codes, and an allocation of tasks in order to achieve certain goals. The organisation tries to preserve itself in the face of external and internal threats*" (Conklin, 2009, p.73).

In relation to theories of criminal behaviour, Akers (1999) highlights that there are many theories available which can be used by criminologist and law enforcement to investigate and understand crime; most of them attempt to answer the question of why social and legal norms are violated. The author further mentions that this question has two inter-related parts, namely why there are variations in group rates of crime and deviance, and why do some individuals come to commit criminal and deviant acts (Akers, 1999, p.4). Hence, the first part of the question focuses on societal and group patterns and the second part on individual differences.

Akers (1999) refers to theories that addresses the broader question about differences across societies or major groups in the society as macro or social structural theories. The author also refers to theories that focus on small group or individual differences as micro or processual theories. Furthermore, Akers compares and contrasts the two types of theories and emphasizes that social structure theories are based on the premise that the proportion of crimes among groups, classes, communities or societies differ due to variations in their social or cultural make-up. On the other hand, theories that explain the processual aspect of crime assert that an individual commits criminal acts due to a particular life history, innate set of individual characteristics and/or encountered a particular situation. More importantly, Akers emphasizes that any theory that attempts to explain crime based on behaviour and patterns should focus on both structural and processual distinctions.

Akers (1999) further classifies theories of criminal and deviant behaviour into four classes, namely:

- Biological theories – Theories that explain crime with one or more genetic, chemical, neurological or physiological variables;
- Psychological theories – Theories based on personality, emotional maladjustment, mental retardation, psychic disturbance or psychological traits;
- Social-psychological theories – Theories that account for crime by reference to behaviour, self and cognitive variables in a group context; and
- Sociological theories – Theories that explain crime with cultural, structural and socio-demographic variables.

In general, both biological and psychological theories mainly focus on individuals who commit crime, whereas social-psychological and sociological theories are in particular relevant to group orientated crimes. Since organised crime is per definition a group orientated crime, it is natural and prudent to include social-psychological and sociological variables as part of the all-inclusive taxonomy.

Moreover, Clark (2004) highlights that policing in the past has mostly focused on successful prosecution of offenders in the criminal court, but this situation is fast changing as policing is now moving towards problem-orientated models that embrace social solutions in terms of crime matters. This situation is also true for organised crime, and Clark (2004) argues that the modern concept of problem-orientated policing requires that organised crime be redefined in terms of sociological and political science terminologies to allow for a better understanding of the phenomenon, as well as to identify opportunities for community-based policing initiatives to be utilized to counteract the criminal threats.

Having presented background information on organised crime and transnational crime in this chapter and on criminal investigative process, it is now possible to define a new all-inclusive taxonomy which classifies organised crime. The aim of this new taxonomy is to enable organised crime analysts to get a better understanding of the criminal environment in general, the relationships between groups, and identify commonalties and differences. As a consequence of the better understanding of the phenomenon, many new countermeasures could be defined and implemented, such as strategies and technical measures.

Figure 2.6 depicts the new taxonomy termed Holistic Taxonomy of Organised Crime. The genus concept of the taxonomy is organised crime and it comprises eight specie sub-concepts, namely organised crime perpetrators, organisational structure of organised crime organisations, motivation to commit organised crime, organised crime activities, tools used by organised crime members, generic phases followed by organised crime members, categories and/or results of criminal attacks, and applicable investigation theories.

The *first fundamentum divisionis* used to delineate the taxonomy relates to the economic impact of organised crime groups in the society and the selected objects range from syndicates to street gangs. As highlighted by the ACC (2016), syndicates have an immense financial impact on the economy of a state or country. On the other hand, Lyman & Potter (2004) suggest that street gangs are more concerned about ethnic heritage and desire to guard territory and less about the monetary proceedings or criminal activity.

The *second fundamentum divisionis* is based on the configuration and chemicals of the structure of organised crime organisations. This divisionis segregates organised crime organisations in terms of the association strength between members, and the direction of operation and management of legal and illegal activities. In terms of hierarchical based organisations, such as a mafia group, the structure normally represents a tightly connected network with management communication directed vertically, and operational communication flowing horizontally. On the other end of the spectrum, criminal network, such as syndicates, are extremely loosely connected networks, highly adaptable, fluid networks of individuals that engage themselves in illicit activities with regularly shifting of alliances (Cressey, 1997; United Nations, 2002, p.41). According to Bell & Congram (2014) the shape of the organisation and membership are continually changing depending on the individuals, attributes and/or skills required. The structure of the organised crime organisations also includes the users of the illicit goods and products.

The *next fundamentum divisionis* focuses on the reason why group members are committing organised crime activities. Most contemporary organised crime group members are profit motivated, mainly to uphold a luxurious lifestyle or for monetary gain (United Nations, 2002, pp.39 –

41; Bell & Congram, 2014, p.49). Traditional organised crime members normally focus on both financial and culture/status benefits, such as the mafia, outlaw motorcycle gangs and street gangs (Alach, 2011, pp.67-68). Further to that, terrorist groups who exert organised crime as their vehicle to finance their activities are motivated by both financial and political benefits.

The *fourth fundamentum divisionis* relates to the activities performed by group members in order to achieve their objective. The activities range from money laundry to terrorism. Conklin (2009), Abadinsky (2010) and Grennan & Britz (2006) highlighted that most of these activities are primarily performed in the pursuit of monetary benefits and profits through illegal means.

The *following fundamentum divisionis* is based on the tools used by organised crime groups to coordinate and plan activities, marketing and distributing illicit services and goods, sustaining the organisational structure and obstructing the law enforcement efforts. According to Bell & Congram (2014), the most important tools range from computer equipment to Voice Over Internet Protocol (VOIP) telephony services. The predominant usage of these tools is for both verbal and non-verbal communication that occurs within the criminal network.

The *six fundamentum divisionis* relates to the modus operandi of offenders and concentrates on the generic phases performed by organised crime groups before, during and after completion of illegal activities. Daniels et al. (2016) and the UN (2000) highlight a number of generic phases performed by organised crime groups which include, among others, planning, preparation, execution, direction and control.

The *next fundamentum divisionis* articulates organised crime in terms of the criminal outcome of the five generic phases. Lyman & Potter (2004) describe six general categories or results which range from provision of illicit services to corruption. Section 2.3.3 describes each outcome in more detail.

The *last fundamentum divisionis* describes the organised crime concept from a criminal behavioural perspective. Both social-psychological theories and sociological theories are used to understand the behaviour of criminals, as well as causes of crime that are inextricably linked to the nature of the society as a whole. In essence, the divisionis articulates perpetrators based on the fact that different societies give rise to different social structures that in return results in different kinds of behaviour.

Finally, as highlighted before, the sequence of succession of fundamenta divisionis is an important indicator of which concept or idea is the most important aspect of the taxonomy. For this taxonomy the order of successional divisionis ranged from organised crime perpetrators to applicable investigation theories. However, it should be noted that all eight concepts are important to describe organised crime and is therefore being taken into consideration to identify patterns, relationships, commonalities and difference in the organised crime environment.

Organised Crime Perpetrators	Organisational Structure	Motivation	Organised Crime Activities	Tools	Generic Phases	Category /Results	Theories of Criminality
Criminal Syndicates	Hierarchical Organisation	Financial Gain	Money Laundering	Computer Equipment	Planning	Provision of Illicit Services	Social Psychological Theories
Outlaw Motor Cycle Gangs	Strong Network (Secretly)	Acceptability and Status Gain	Loansharking	Commercial Communication Networks	Preparation	Provision of Illicit Goods	Sociological theories
Professional Facilitators	Loose Network (Overtly)	Political Gain	Drug Trafficking	Mobile Phones	Execution	Conspiracy to Commit Crime	
Street Gangs	Core Group		Sex / Human Trafficking	Short Message Services (Text)	Direction	Penetration of Legitimate Business	
	Criminal Network (Protectors & Specialised Support)		People Smuggling	Electronic Mail	Controlling	Extortion	
	Users of illicit Goods and Services		Arm Trafficking	Message Forums			
			Endangered Species Trafficking	Instant Chat Services		Corruption	
			Cybercrime	Social Media			
			Terrorism	VOIP Telephony Services			

Figure 2.6: A Holistic Taxonomy of Organised Crime

2.11   Conclusion

The proliferation and globalisation of organised crime is a cause for great concern amongst society and governments around the world. As highlighted by many venerable authors, there is a great exigency to deal with organised crime from both an operational and policy perspective. However, as alluded to by the authors, there is a substantive need to develop a broader framework or model which could be used by both policy-makers and law enforcement agencies to comprehend the phenomenon better and to devise strategies and technical measures to combat the ever-increasing threat.

This chapter has presented background information on organised crime. Organised crime in its traditional forms was first analysed, which included groups, such as Sicilian Mafia, Chinese Triad and Tong groups and the Japanese Yakuza organisation. These groups were investigated in terms of their origins and in their continuity of traditions and structures. It was highlighted that most of these groups started out as a highly discipline organisation, following traditions and cultural principles within a highly covert, tightly connected hierarchal structure. However, some of these groups, such as the Chinese Triad and Tong groups, have adopted a structure that is more fragmented and complex compared to traditional organisational structures. It was also established that all of these groups expanded their activities to the international market to maximise their profit and minimise the likelihood of being detected by law enforcement agencies.

Current investigative and counter measures, together with the future of organised crime, were also scrutinised in the middle part of the chapter. The focus was on determining how governments deal with organised crime from a local, national and international perspective. It was stressed that most law enforcement agencies make use of both regulatory strategies and technical measures to tackle specific cases and to bring offenders to justice. As highlighted by Wright (2006), there is sometimes either a poor understanding of the phenomenon or mismatch between high level strategies and the implementation of subsequent policies and technical measures on ground level. Consequently, the need for a new framework or model has come to prominence, which can be used by both policy-makers and law enforcement agencies to comprehend organised crime in more detail; subsequently defining more applicable and practical strategies which can be implemented more easily by law enforcement agencies.

In order to get a better comprehension of the criminal environment pertaining to organised crime and subsequently delineating a new framework or model, it is important to classify the criminality. Taxonomies are used by researchers to understand the relationships between criminal groups, identifying commonalties and differences, and develop effective counter measures and/or models. The latter part of this chapter has focused on an overarching all-inclusive taxonomy, termed holistic taxonomy of organised crime, which encompasses the most important aspects of the phenomenon as outlined in this episode.

The next chapter considers ways and means how this holistic taxonomy can be implemented by researchers and law enforcement officers to get a more in-depth understanding of the phenomenon. The two most widely used theory streams of criminal and deviant behaviour are considered with the aim of identifying generic characteristics and attributes what can be used in

future chapters to define a new conceptual model, as well as to scrutinise and discuss substantive organised crime cases.

Chapter 3

Introduction to Criminological Explanations of Organised Crime: Variables and Interrelationships

Introduction to Criminological Explanations of Organised Crime: Variables and Interrelationships

This chapter focuses on:

- Articulating general characteristics of criminal behaviour;
- Describing relevant social-psychological and sociological theories applicable to organised crime;
- Unfolding social networks from a group perspective; and
- Delineating a generic list of independent variables and interrelationships which can be used to investigate actual organised crime cases.

3.1   Introduction

The previous chapter concluded with a universal definition of organised crime, together with a holistic taxonomy which outlines the main components of the phenomenon. Although it has been concluded that the term organised crime is ambiguous and vague, a universal definition has been offered which also forms the nucleus of this chapter. Therefore, organised crime has been defined as "a c*riminal activity by an enduring structure or organisation developed and devoted primarily to the pursuit of profits through illegal means…organised crime has the characteristics of a formal organisation: a division of labour, coordination of activities through rules and codes, and an allocation of tasks in order to achieve certain goals. The organisation tries to preserve itself in the face of external and internal threats*" (Conklin, 2009, p.73).

In order to investigate and enlighten the criminal activities performed by organised crime organisations, it is important to analyse existing theories of crime to provide meaningful insights into consistent patterns of behaviour and shared attributes (Shoham & Hoffmann, 1991, p.1). White and Perrone (2010) highlight that attributes of crime in a criminological perspective attempt to explain criminal behaviour or criminality at the individual, situational and structural levels, and are generally referred to as variables of crime. Furthermore, according to Akers (1999), one of the most respected and referenced authors of criminological theories, a theory if developed properly, should represent real and substantive situations, feelings, experience and human behaviour.   The author also highlights that an effective theory should assist criminologists, crime investigators and researchers to make sense of facts that they already know and can be tested against new facts (Akers, 1999, p.1).

Bartol & Bartol (2014) concur with Akers (1999) and elaborate further by stating that theories should present a systematic view of crime by also specifying relations among variables, with the purpose of explaining and predicting the phenomenon. The authors furthermore state that theories of crime should provide a general explanation that encompasses and systematically connects many different social, economic and psychological variables to criminal behaviour (Bartol & Bartol, 2014, p3).

There are many different theories available to make sense of criminal facts; most of them have been derived from various sciences dealing with human behaviour. The most common classification of criminological theories is: biological theories, psychological theories, social-psychological theories and sociological theories (Bartol & Bartol, 2014, p.7-10; Akers, 1999, p.5; Shoham & Hoffmann, 1991, p.2). In addition, to explore criminal behaviour in terms of these theories, Shoham & Hoffmann (1991) also highlight that law enforcement, courts and correctional institutions should take the criminal law into consideration when studying any crime, such as organised crime. For this reason, Burkhead (2006) defines criminology as a scientific study of crime, criminals and criminal behaviour, as well as the interaction between criminals and the criminal law.

In fact, according to Shoham & Hoffmann (1991), it is imperative to note that most criminological theories tend to focus on particular shared attributes (variables) of human behaviour and with systems of relationships between social norms, of which criminal law is an integral part (Shoham & Hoffmann, 1991, p.3). However, from a general research perspective, criminological theories are part of the study of all types of social deviance; they deal with factors and processes that lead an individual or group to obey and care for social norms or to violate and deviate from them (White & Perrone, 2010, p.50). Hence, for this reason many researchers are not focusing on criminal law per say, but more so on social norms, when investigating crime in general.

Furthermore, Shoham & Hoffmann (1991) argue that the formal difference between the norms of the criminal law and other social norms, which constitutes to a violation of the criminal law, is an instantiation of social deviance. For this reason, they recommend that researchers, who need to interrogate the complex topic of crime, follow a methodology which describes and elaborates theories of crime under a sociological framework (Shoham & Hoffmann, 1991, p.3). With this in mind and based on the definition of organised crime, it could be argued that most criminal offences related to the phenomenon are a form of human behaviour that violate and deviate from the social norm, and are executed by groups or organisations within the society. As a consequence, it seems that the fields of social-psychology and sociology are best suited to infer the phenomenon.

The focus of this chapter is not to provide a profound explanation of the two fields, nor to describe applicable laws: the focus is rather on identifying a number of potential variables (information sources) and interrelationships that could be used to unearth knowledge and to provide new insights about organised crime, which could ultimately lead to advanced investigation and examination of organised crime cases.

The chapter commences with a high-level visitation into delinquency and crime from a general perspective with the focus on identifying suitable attributes/variables, which could assist with the comprehension of various patterns and trends in criminal behaviour. Next, theories of crime from social-psychological and sociological perspectives are articulated, by concentrating on common

psychological and sociological attributes/variables used to explain deviant and criminal behaviour. This is followed by a high-level examination of social networks with a particular emphasis on unique attributes/variables in a group or organisational context. Finally, the chapter concludes with a summary of all the attributes/variables selected from the applicable theories and the application of them on a substantive organised crime case.

3.2   Broad-spectrum Explanation of Crime

Before investigating crime and criminal behaviour, it is important to briefly delineate the main dimensions of crime. Burkhead (2006) highlights four important dimensions of crime which need to be clearly understood before assessing characteristics and relative merits of theories, claims, and proclamations as to what causes crime: crime, criminality, elements of crime and criminology.

White & Perrone (2010) simply define crime as acts that are legally condemned by the state and deemed to be deserving of punishment and control. Burkhead (2006) supports this definition and concludes that the study of crime focuses on offenses, such as organised crime. Criminality, on the other hand, refers to the propensity of an individual person to commit crimes and therefore the study of criminality focuses on the behaviour aspect of offenders (Burkhead, 2006, p.34).

According to the criminal law, two elements must be present in order to constitute a crime, namely the act and the intent. The act denotes a prohibited conduct that must have been performed voluntarily, whilst the intent refers to the state of mind of the accused that accompanied the prohibited conduct (White & Perrone, 2010, p.6). As a result, based on the criminal law, it is important to consider both the activity and behaviour of suspects or offenders when studying crime.

In terms of criminology, White & Perrone (2010) define it as, *"the systematic study of crime, criminality and criminal justice systems, focusing on criminalisation as a process, the definitions and causes of crime, crime prevention, systems of social control and the treatment, rehabilitation and punishment of offenders"*. Bartol & Bartol (2014) concur with above definition of criminology and highlight that it involves a multi-disciplinary study of crime. Many disciplines are exerted to gather knowledge about criminal activities and behaviour, such as sociology, psychology, biology, political science and economics. Some of these disciplines are utilized in forthcoming sections of this chapter to conceptualised behavioural aspects of organised crime.

Besides these multi-disciplines, White & Perrone (2010) claim that criminologists, crime investigators and researchers also exploit other sub-disciplines, concepts and general variables to understand, explain, prevent and change criminal behaviour. Moreover, general variables are normally used to point out the significant relationships with certain categories and patterns of crime. Some venerable authors of crime and criminality describe this exploratory process as "Correlates of Crime" and apply four general variables to examine crime, namely, age, gender, race and intelligence quotient (IQ) (Burkhead, 2006, p.46).

The rest of this section focuses on two aspects: Firstly, to articulate the four general variables used to analyse crime and in particular to relate them to organised crime, and secondly to provide a short summary of other general variables used by crime investigators to describe crime in general.

3.2.1   Age and the Explanation of Crime

Burkhead (2006) describes age as the strongest and most consistent relationship with criminal behaviour. Sweeten, Piquero & Steinberg (2013) agree with Burkhead and highlight that age is one of the most robust correlates of criminal behaviour, yet the explanation as to why it is the case varies.

Central to the robustness of the relationship between age and crime is the so called, 'age-crime curve'. Many researchers and criminologists have found that antisocial and criminal activity increases during adolescence, peaks around the age of 17 years and declines as individuals enter adulthood (Sweeten, Piquero & Steinberg, 2013, p.921; Burkhead, 2006, p.47). This conclusion is based on statistics gathered over a period of 150 years around the world, across many samples that vary in their ethnicity, national origin and historical era (Farrington et al. 2013; Piquero et al. 2007). According to Burkhead (2006) the relationship between age and crime is so strong that it holds truth for most types of crime, graphs of arrests, graphs of convictions or graphs of imprisonments. For the matter of fact, the data is so consistent that the famous English scientist, Charles Goring, claimed that age was the most robust constants of crime and referred to this finding as the 'law of nature' (Burkhead, 2006, p47).

Some researchers utilize developmental theories to explain the robustness of the relationship between crime and age and point out that the multitude of sociological, psychological and biological changes that occur during adolescence and adulthood could be used to explain the relationship. Other prominent criminological researchers, such as Gottfredson and Hirschi, claim that age has a direct effect on crime, which cannot be explained by sociological and psychological variables (Sweeten, Piquero & Steinberg, 2013, p921).

Notwithstanding the different views, most venerable and prominent criminological researchers agree that the relationship between age and crime is so strong and consistent that it should be included in any theory or investigation into crime (Burkhead, 2006, p.47). For this reason, the age variable is selected as one of the variables to assist with the investigation of organised crime. Moreover, the age variable could be applied to the organisational structure of organised crime, as outlined in the holistic taxonomy in the previous chapter, and as a consequence the age of core members, criminal network members and users is of concern when investigating organised crime (Bartol & Bartol, 2014, p.252).

Furthermore, Shoham and Hoffmann (1991) have highlighted that an investigation, or measuring of crime by means of variables, should be done across the process of crime reporting and recording in order to ensure that the correct conclusions are made. For example, to comprehend how complex the process of identifying, investigating and

prosecuting an organised crime syndicate is, one needs to identify the age of core members and criminal network members from when they commit the crime to that point when they are convicted. Figure 3.1 depicts the process of crime reporting and recording and comprises ten (10) stages. The figure shows that the process starts with an offense and concludes with the release of the offender after being rehabilitated. Hence, for this thesis, the age of core members, criminal network members and users of illegal and illicit goods and/or services will be recorded through all ten stages of crime reporting and recording.
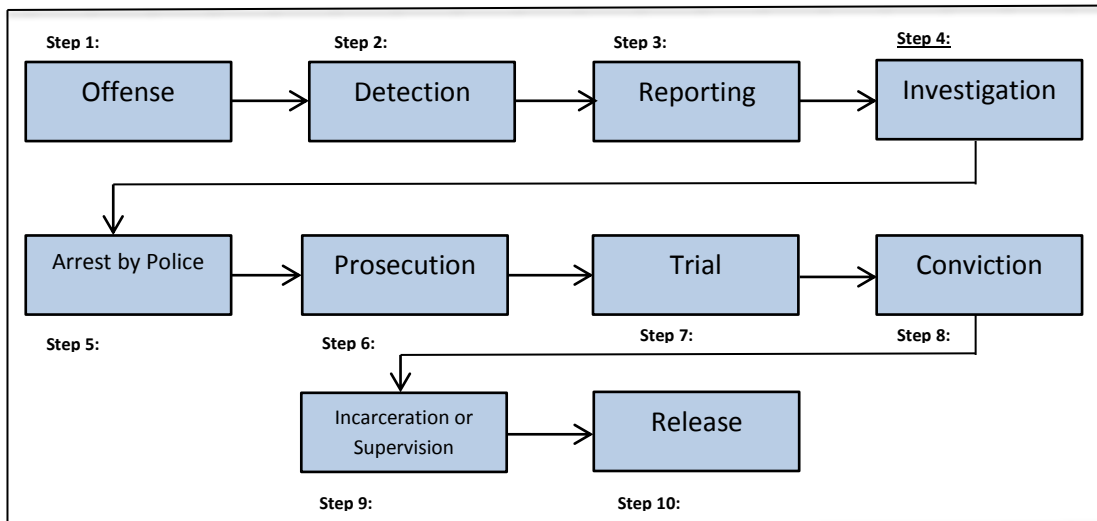
Figure 3.1: The Process of Crime Reporting and Recording [Adapted from: (Shoham & Hoffmann, 1991)].

3.2.2   Gender and the Explanation of Crime

Burkhead (2006) refers to gender as the second strongest and most consistent characteristic used to describe criminal behaviour. He claims that men are always more likely to commit crime at any age compared to females, regardless of crime type, source of data, level of involvement or measure of participation. Last mentioned statement is again backed-up by many years of statistical data, such as the uniform crime reports of the Federal Bureau of Investigation (FBI). For example, the uniform crime report of the FBI for the year 2002 has revealed that males have committed 77% of the overall crime in the US, whilst females were responsible for only 23% of the overall crime (Burkhead, 2006, p.50). Burkhead (2006) has further revealed that the number of females arrested between 1993 and 2002 has increased by 14.1% (Bartol & Bartol, 2014, p.251).

Likewise, when comparing and contrasting the data of the uniform crime report for the year 2013 against the respective report in 2002, one finds remarkable similarities. In 2013, 73.5% of all arrestees in the US were males and only 26.5% were females (FBI, 2013). Conversely, the number of females arrested between 2002 and 2013 has increased by 3.5%.

Burkhead (2006) claims the strong gender contrast for criminal behaviour and the gradual increase in female conviction rate is due to biological reasons and the social learning of

gender roles. There have been a number of scientific studies conducted in the past to explain why there is a difference in male and female criminality, such as Cesare Lombroso study on female criminality trends (Smart, 2013, pp.1-76), Thomas study on Sex and Society (Thomas, 2015), Pollak research on social learning of females (Pollak & Watkins, 1993) and so forth. Burkhead (2006) concludes that none of these studies has conclusively explained the gender difference in crime. However, the studies have highlighted that it remains a compelling variable to investigate and to assist with the understanding of patterns in crime networks. Based on the remarkable consistent relationship between gender and criminal behaviour, it is decided to select the gender variable to investigate organised crime. As with the case of the age variable, the gender variable is also applied to the organisational structure of organised crime. Subsequently the focus is on the gender of core members, criminal network members and users when investigating organised crime.

3.2.3   Race and the Explanation of Crime

Another general variable often used to describe and investigate crime is racial or ethnic variable. Despite the weaker and less robust relationship between racial variable and crime, Burkhead (2006) still argues the importance of the variable in order to get a better understanding of any crime investigation. As with the case of the previous two variables, statistics over many years have revealed that 'Blacks' (also referred to as non-Caucasians) commit more crime than 'Whites' (Caucasians), who in return commit more crimes than 'Asians' (Burkhead, 2006, p.55). According to Burkhead (2006), the statistics which have been kept in the US, have revealed that non-Caucasians are over-represented at every stage of the criminal justice system, from reported crimes, to arrests, to convictions, to incarceration. The same pattern has also been found in the UK by Rutter and Giller, as well as 88 other countries through research conducted by Rushton (Bartol & Bartol, 2014, p.251; Burkhead, 2006, p.55).

Burkhead (2006) attempts to explain above trend by applying both biological and sociological theories, but concluded that biological explanations, such as Intelligence Quotient (IQ) or temperament, are not adequate to explain the patterns. On the contrary, he argues that sociological theories, such as strain theory, are more suited to explain the patterns.

Nonetheless, the explanation for the reasonably close relationship between race and crime is highly contentious and sensitive. Subsequently, the racial variable is included as one of the selected variables, but no specific mention towards the variable is made during the interference section of the thesis. More importantly, the focus of interference is on the factors that determine ethnic identity, namely, language, religion, culture, geography and history.

3.2.4   Intelligence Quotient and the Explanation of Crime

Arguably the most contentious general variable used to explain crime is Intelligence Quotient (IQ). According to Burkhead (2006) most experienced researchers who specialised in analysing offender profiles concluded that many perpetrators have a below average

intelligence. The author further points out that aggregate data, gathered over the last century, strongly put forward a case which illuminates intellectual deficits in the criminal population.

More importantly, he argues that IQ relates differently to the various types of crime committed by offenders. For instance, crimes such as bribery, forgery and embezzlement are generally associated with higher IQ offenders, while assaults, homicide and rape are normally associated with lower IQ perpetrators. Conversely, property offenders, burglars, auto thieves, and alcohol and drug offenders are considered as having average IQ (Burkhead, 2006, p62).

Although the relationship between IQ and crime could provide important explanations as to why and how offenders are committing crime, it does post certain limitations. There is a misconception that IQ and crime have negative connotations with race and ethnic groups resulting in many criminologists not focusing and utilizing the variable. Secondly, and more importantly, the IQ of most offenders is not readily available and in most cases IQ analyses are done with incarcerated populations. Therefore, it is important to obtain reliable IQ data on offenders, especially organised crime offenders. Nonetheless, the variable has the potential of providing useful insights in organised crime, and is therefore included in the list of selected variables.

3.2.5 Crime Statistics

In section 3.2.1, the process of crime measurement was briefly introduced. At large, crime measurement is extremely complex due to the difference in criminal law within states, territories and countries (White & Perrone, 2010, p.26), and as a consequence it does not form part of this research project. Notwithstanding the complexity, most criminologists rely heavily upon crime statistics in order to interpret and interrogate crime. For instance, researchers normally examine several years of statistical data to identify common trends in burglary (White & Perrone, 2010, p.30).

According to White & Perrone (2010), many researchers and policy-makers in the discipline of crime frequently refer to official sources of data to substantiate their work. Such statistical information is normally collected by police services/forces, correctional services, crime prevention units and regulatory agencies (White & Perrone, 2010, p.28; Bartol & Bartol, 2014, p.14). Most of the crime reports comprise many general variables which are used to explain crime trends. For this reason, it was decided to include a number of these general variables in the list of selected variables.

The uniform crime reports produced by the FBI since 1930, is one example of statistical information that is available to criminologists and researchers. According to Bartol & Bartol (2014), this report is the most cited source of US crime statistics. Many researchers across the globe also analyse this report to comprehend the trends in the US and subsequently compare and contrast the trends against other countries' crime statistics.

The unified crime report provides comprehensive information regarding crimes known to police, which includes information about the city and state where the crime was committed. Information about arrests made during the period of concern includes several general variables, such as age, gender and race. The report also includes two important variables relating to the type of crime. The first variable grouped the serious crime together whilst the second variable represents the non-serious crime. See section 3.7 for a list of serious and non-serious crimes (Bartol & Bartol, 2014, p.14).

Other two useful variables exerted in the report include weapon or tool used to commit crime and relationship between victim and offender (FBI, 2012). The weapon or tool variable is in general indicative of the nature, severity and complexity of criminal activities committed by criminal groups, such as organised crime organisations, while the relationship of victim to offenders provides valuable information about normal business operation and illegal markets. Subsequently, these two variables are also included in the list of selected variables.

This section elaborated on the four most common variables used by criminologists and researchers to investigate and comprehend various patterns and trends of crime and criminal behaviour. As pointed out by Burkhead (2006), these four general variables could be extremely contentious, yet it remains the best available variables to interpret crime data. Three other common variables used in reporting crime statistics have also been articulated. The next section provides a background on criminological theories to further investigate organised crime.

3.3   Theories of Crime

The previous section introduced the four most common variables used to investigate criminal cases such as murder, rape and fraud. Akers (1999) argues that the more variables used to articulate crime and criminal behaviour, the stronger the correlations and associations will be and the greater the empirical validity. However, the author also cautions that not all variables always explain all type of criminal behaviour or decisions that lead to arrest of offenders. Therefore, he suggests that an extensive list of explanatory variables (also referred to as independent variables) being articulated for each category of crime. Moreover, the author also proposes that the variables must be practically implementable in order to measure and explain crime related events (Akers, 1999, p.1 – 12). The rest of this section briefly introduces criminological theories with the purpose of identifying which theories are best equipped to pinpoint additional variables for investigating organised crime.

Akers, one of the leading international researchers in the field of criminological theories, highlights that although criminological theories are abstract, it is essential for academic researchers in criminology to comprehend and evaluate the major theories of criminology. The author further claims that these theories are part of the broader social science striving to explain human behaviour and society. Akers classifies criminological theories into two distinct groups based on the definition

from Sutherland. Sutherland (1947) has defined criminology as the study of the entire process of law-making, law-breaking and law-enforcing (Akers, 1999, p.2). Akers (1999) uses the law-making and law-enforcing components of this process to articulate the first group of theories. This group of theories clusters all relevant theories which aim to account for why societies have laws and why the criminal justice system operates in its current mode. The second group of theories accounts for criminal and delinquent behaviour and they attempt to explain any deviant behaviour that violates social norms, irrespective whether or not such behaviour is deemed to violate the law.

Akers (1999) claims that the first group is very limited in terms of available theories, while the second group contains a plethora of matured theories. Therefore, he argues that it is imperative for researchers to focus on the second group of theories (Akers, 1999, p.2).

The second group of theories, namely theories of criminal and deviant behaviour, examines crime by try to answer the question of why social and legal norms are violated. Akers (1999) sub-divides this group into two sets. The first set the author refers to as the macro theory of criminal and deviant behaviour which endeavours to answer why there are variations in group rate of crime and deviance. This theory focuses on societal and group patterns that address the differences across societies or major groups in society. The second set Akers calls the micro theory of criminal and deviant behaviour that strives to answer why some individuals come to commit criminal and deviant acts. Therefore, the major difference between the two sets of theories is the level of analysis. For example, macro theories, on the one hand, focus on explaining why groups or societies are or are not committing crime and deviance acts, and investigate classes, communities or cultural make-up. On the other hand, micro theories focus on individuals by considering life history, individual characteristics or particular situation that increases the probability that an individual might commit a criminal or deviant act (Akers, 1999, p.5).

Akers concludes the classification of criminal and deviant behaviour by linking the macro and micro theories to academic disciplines. He groups theories related to biological and psychological disciplines as micro theories and theories pertaining to the sociological and social-psychological disciplines as macro theories (Akers, 1999, p.5).

Bartol & Bartol (2014) concur with this classification of theories of crime, but highlight that no theory is more superior to others, or that no theory is incorrect. They also suggest that there is no all-encompassing theory that fully explains the actions of all offenders (Bartol & Bartol, 2014, p.7). Moreover, Bartol & Bartol (2014) suggest that by scrutinising the definition of crime is one way in which researchers could analyse crime and apply the plethora of macro and micro theories.

As per the definition of organised crime in the previous chapter, this crime is predominately performed by loosely or tightly connected groups whose primary objective is to obtain money through illegal activities. As a consequence, the macro theories as grouped by Akers should provide profound insights into organised crime. Akers (1999) and Cullen (2002) recommends social learning theory (Maisto, Carey & Bradizza, 1999, pp.107-112), control theories (Cullen, 2002, pp.77-108) and labelling theory (Carrabine et al., 2009, pp.90-98) as fitting social-psychological macro theories which can be used to identify suitable variables and to investigate crime. Akers (1999) also proposes anomie/strain (Walsh, 2010, pp.65-75), conflict (Carter et al., 2012, pp.1-23), Marxist (Ratner & Silva,

2017) and feminist theories (Saulnier & Saulnier, 1996; Carter et al., 2012, pp.105-132) as appropriate sociological macro theories to investigate crime (Akers, 1999, p.6).

Each of the social-psychological and sociological macro theories is being articulated next, with the focus on how to apply them in terms of organised crime. The aim is not to provide an in-depth description of each theory, as each theory is a discipline on its own. However, the main aim is to replicate and extend the current knowledge about organised crime by applying the respective suitable variables in order to obtain a better understanding of the organised crime phenomenon. For this reason, the next two sections focus on the three social-psychological and four sociological macro theories of crime. The format of discussion in each section follows a methodical structure which includes: a brief description of each theory, identification of variables exerted for each theory and a selection of suitable variables for investigating organised crime.

3.4   Social-psychological Explanation for Crime

As concluded in the previous section, social-psychological macro theories of crime are discussed next with the aim of identifying suitable variables which can provide a better understanding of the organised crime discipline. Before exploring these macro theories, it is important to describe social-psychology in general so that it can serve as a baseline when briefly explaining the three theories of concern.   Vaughan & Hogg (2014), who are well respected authors in the field of social-psychology, argue that social-psychology is a sub-discipline of general psychology and is therefore concerned with explaining human behaviour in terms of processes that occur within the human mind. They also illuminate the main difference between social-psychology and general psychology in that social-psychology explains social behaviour and not individual behaviour, as in the case of general psychology.

Subsequently, Vaughan & Hogg define social-psychology as "the scientific investigation of how the thoughts, feelings and behaviours are influenced by the actual, imagined or implied presence of others" (Vaughan & Hogg, 2014, p.2).   Behaviour in this context mainly refers to what people actually do, such as running, kissing, driving, raising eyebrows, smiling, dressing, speaking and writing. They also state that behaviour can be objectively observed and measured in most instances, which make it very suitable for investigating other disciplines, such as crime.

Furthermore, Vaughan & Hogg claim that social-psychology is a science because it exerts scientific methods to construct and test theories. It is important to note that social-psychology does differ from other disciplines, such as physics, chemistry or biology in the sense that the former analyses human social behaviour by means of scientific methods, while the latter analyses non-organic phenomena, and chemical and biological processes.   Methods for studying topics of concern involve the collection of data to test hypotheses. Hypotheses, or predictions, are formulated on the basis of previous knowledge, speculation and casual or systematic observation.   Also, theories in social-psychology mostly relate to a set of interrelated concepts and principles that explain a particular phenomenon (Vaughan & Hogg, 2014, p.6).

Many social-psychologists utilize two broad types of method to empirically test the hypothesis, namely experimental and non-experimental methods (Martin, 2008, pp.5-13). Experimental methods, or also known as causal experimentation, is concern about testing a hypothesis by changing something to witness the effect thereof on something else. Therefore, experimentation involves intervention in the form of manipulation of one or more independent variables, and subsequently measuring the effect of that manipulation on one or more focal dependent variables. Thus, independent variable configurations of a situation either change by their own accord or can be manipulated by an experimenter to have effects on a dependent variable. For example, if a scientist needs to test the effect of tyre pressure on fuel consumption, then the independent variable could be the tyre inflation, which can be manipulated by two experimental conditions, namely, lower and higher pressures. The dependent variable could be fuel consumption, which could be measured on refilling the tank at the end of the testing period (Vaughan & Hogg, 2014).

Although experimentation is the preferred method of testing a hypothesis; in social-psychology there are circumstances where it is impossible to conduct experiments. For example, if a social-psychologist needs to test the relationship between biological gender and decision-making, it would be impossible to do sensible experimentation due to the lack of manipulating biological gender. Another example is to test the hypothesis about the effects on self-esteem of being a victim of violent crime. When using non-experimentation in social-psychology, it is almost impossible to draw reliable causal conclusion. Indeed, experimenters can only claim that there is a correlation between independent and dependent variables. Examples of non-experimental methods include, amongst other, archival research and case study (Vaughan & Hogg, 2014, p.6; Martin, 2008, pp.5-13).

The test of hypotheses is normally underpinned by well establish social-psychology theories. Theories in social-psychology can generally be clustered into different types of theory (Van Lange, Kruglanski & Higgins, 2013, cited in Vaughan & Hogg, 2014, p.17), and each type of theory could indicate different meta-theories. In this context, theories are sets of interrelated concepts and principles that explain a phenomenon. Likewise, meta-theories are also sets of interrelated concepts and principles about which theories or types of theories are more appropriate. The major types of theories include, among others, Behaviourism, Cognitive Psychology, Neuroscience and Biochemistry, Evolutionary Social-psychology, Personality and Collectivist theories (Vaughan & Hogg, 2014, p.17 – 20).

Vaughan & Hogg (2014) argue that certain theories are more attuned to account for almost the whole of human behaviour. Akers (1999) agrees that certain social-psychology theories can contribute to the investigation of crime and in particular to comprehend criminal behaviour. Akers also emphasises that certain criminologists have applied some of the most prominent social-psychology theories to delinquent and deviant behaviour, and subsequently proposed applicable criminal theories (Akers, 1999, p.59).

Akers has identified three major social-psychologically oriented macro theories, namely social learning theory, control theories and labelling theory (Akers, 1999, p.6). Each of these theories is discussed in more detail in the rest of this section and is structured as follows:

- A brief description of each theory;

- Identification of variables exerted for each theory;
- Case study; and
- Verification of variables for investigating organised crime.

3.4.1 Social Learning Theory

Social learning theory in terms of criminal behaviour mainly applies to the theory of crime and deviance developed by Ronald L. Akers (Capece & Lanza-Kaduce, 2013, p.518; Akers, 1999, p.59). Akers' social learning theory in its basic form is based on the behaviouristic reformulation of Edwin H. Sutherland's differential association theory of crime. It is a general and mature theory that has been applied to a diverse range of deviant and criminal behaviours. It is also one of the most frequently tested theories in criminology (Akers, 1999, p.59).

Sutherland was a leading sociological orientated criminologist of the twentieth century and claimed that 'differential social organisation' is the cause of differences in group or societal crime rates, which is consistent with differential association as the explanation of differences in individual behaviour. In terms of Akers' classification of criminal and deviant behaviour, differential social organisation can be classified as a macro or structural theory, and differential association as a micro or processual theory (Akers, 1999, p.60).

The theory of Sutherland comprises the following constructs:

- *Criminal behaviour is learned;*
- *Criminal behaviour is learned in interaction with other persons in a process of communication;*
- *The principal part of the learning of criminal behaviour occurs within intimate personal groups;*
- *When criminal behaviour is learned, the learning includes: (a) techniques of committing the crime, which are sometimes very complicated, sometimes very simple, and (b) the specific direction of motives, drives, rationalisations, and attitudes;*
- *The specific direction of motives and drives is learned from definitions of legal codes as favourable or unfavourable;*
- *A person becomes delinquent because of an excess of definitions favourable to violation of law over definitions unfavourable to violation of law;*
- *Differential associations may vary in frequency, duration, priority and intensity;*
- *The process of learning criminal behaviour by association with criminal and anti-criminal patterns involves all of the mechanisms that are involved in any other learning; and*
- *Although criminal behaviour is an expression of general needs and values, it is not explained by those general needs and values, because non-criminal behaviour is an expression of the same needs and values* (Akers, 1999, p.62; Newburn, 2017, p.168).

The above extraction of the theory clearly indicates that Sutherland asserted that all mechanisms of learning are involved in criminal behaviour. However, the author did not explicitly explain what the mechanisms of learning are. These learning mechanisms were

specified in detail by Burgess and Akers in their 'differential association-reinforcement' theory of criminal behaviour (Akers, 1999, p.62). Akers (1999) then continued to develop this theory and applied it to criminal, delinquent and deviant behaviour in a general sense and labelled it as 'social learning' theory of crime (Akers, 1999, p.62).

The social learning theory explains crime and deviance by identifying variables which operate on the one hand as motivation and controlling, and on the other hand as promotion and undermining of conformity (Newburn, 2017, pp.168-169). Akers (1999) has claimed that criminal or conforming behaviour occurs as a function of the balance of influences on behaviour. Subsequently, he identified four main concepts or variables that explain the balance notion, which are as follows (Newburn, 2017, p.168):

- Differential Association;
- Definitions;
- Differential Reinforcement; and
- Imitation.

The *first variable (differential association)* refers to the process whereby individuals are exposed to normative definitions which might be favourable or unfavourable to illegal or law-abiding behaviour. The differential association variable is based on two dimensions, namely interactional and normative dimensions. Interactional dimension relates to both direct association and interaction with others, as well as indirect association and identification with more distance reference groups. Normative dimension on the other hand refers to different patterns of norms and values to which individuals are exposed through association (Akers, 1999, p.64).

The *second variable (definitions)* relates to the attitudes or meanings that individuals attach to a given behaviour. Definitions can be in the form of orientations, rationalisations, definitions of the situation or any other evaluative and moral attitudes that delineate the commission of an act as right or wrong, good or bad, desirable or undesirable, justified or unjustified. For instance, Akers (1999) argues that the greater the extent to which an individual holds attitudes that disapprove a certain act, the less likely would it be for the individual to engage in that particular act (Akers, 1999, p.65).

The *next variable* is called differential reinforcement and it refers to the balance of anticipated or actual rewards and punishments that result after completion of a certain act or behaviour. Akers (1999) rationalises that individuals' past, present and anticipated future rewards and punishments for their actions will ultimately refrain themselves from committing a crime (Akers, 1999, p.66).

The *final variable* for the social learning theory is called imitation. The imitation variable focuses on the engagement in behaviour after the observation of similar behaviour in others. Akers (1999) claims that the degree of imitation is determined by the characteristics of the modelling process, the behaviour observed and the observed penalties of the behaviour (Bandura, 1977, cited in Akers, 1999, p.67).

Sutherland (1947), Cressey (1960) and Akers (1992) have all argued that there is a strong connection between social structures and the behaviour of individuals, and this connection should be taken into consideration when practically implementing the variables. They claim that society, community, class, gender, religion and other structures in society all constitute general learning for individuals. However, family, peer groups, schools, churches and other groups provide a far greater context that promote or discourage the criminal or conforming behaviour of individuals. Also, the position of an individual is determined by social structural variables, such as age, sex, race, class and other characteristics (Akers, 1999, p.69).

In 2013, Michael Capece and Lonn Lanza-Kaduce have applied the social structure-social learning theory of Akers on a group of college students to test the hypothesis from Akers' theory that the effects of structural variables will be mediated by social learning processes. The researchers used Core Alcohol and Drug Survey data from eight diverse college campuses throughout the US to study binge drinking. The research has examined 13 structural variables for a wide range of college students. The dependent variable was binge drinking and the independent variables included, among others, age, gender, race, marital status, fraternity affiliations, family relationships, academic status, work status and student status. The results indicated that the three social learning variables (rewards, punishments and definitions) mediated most of the structural effects of binge drinking (Capece & Lanza-Kaduce, 2013).

The above case study highlights the usefulness of the social learning variables when analysing deviant and criminal behaviour. In terms of organised crime, the social learning theory could prove useful in studying the interactions between members inside the organised crime group, between the organised crime group and users/patrons of illicit goods and services, as well as between the organised crime group and law enforcement. Based on Akers' argument that the four social learning variables are well set to predict deviant and criminal behaviour for all general crime, together with the extensive empirical validity of the social learning theory by researchers, such as Krohn, Lonn Lanza-Kaduce, Radosevich, Spear and so forth (Akers, 1999, p.70 – 76), it can be argued that the four variables could also assist in understanding organised crime activities in more detail.

However, Akers has highlighted the fact that the testability of these variables in certain cases might be problematic due to lack of information or misinterpretation of data (Akers, 1999, p.71). In relation to this research project, various different public available data sources are examined to maximise the value of these variables. Further on, a methodical coding process overseen by peer reviewing is exerted to minimising misinterpretation of data. In terms of which variables to include in the list of selected variables, Capece & Lanza-Kaduce (2013) highlights that two of Akers' associates have argued that the differential association concept or variable should not be included when statistically analysing data for social learning effects. They claimed that the conceptual and measurement overlap between the differential association and other learning variables is significant and would be accounted for by the other variables (Capece & Lanza-Kaduce, 2013, p.511). Therefore, the definition, differential reinforcement and imitation variables are included in the list of selected variables.

3.4.2   Control Theories

The next social-psychological crime theory to be discussed is called the control theory. Akers (1999) refers to the control theories as the odd explanatory theory of crime, because it poses an entirely different criminal related question compared to the other theories. Akers (1999) argues that other social-psychological and sociological crime theories are concerned about why certain people in the society deviate from social and legal norms. To the contrary, control theories are concerned as to why people do not violate rules and laws (Akers, 1999, p.79).

According to most control theorists, the answer to last mentioned question of why people conform to rules and laws is due to social controls (Sims, 2002, p.101; Akers, 1999, p.79). Indeed, according to them if these controls weaken or are omitted, people will most probably commit deviant or criminal acts (Reiss, 1951 – Cited in Akers, 1999, p.79). More importantly, Akers (1999) highlights that control theorists are of the opinion that people are motivated to conform to social controls, but need no special motivation to violate laws. He claims that violation of the law comes naturally to most people in the event where controls are absent.

Although a number of control theories were developed between 1950 and 1970, such as Reiss' and Nyo's theory of internal and external controls, Reckless' containment theory and so forth; the most prominent and widely used control theory today was developed by Hirschi in 1969. He called his theory social bonding theory and formulated it based on a number of combined elements of all previous defined control theories. This theory offered a new way to account for delinquent behaviour as he argued his proposition – "Delinquent acts result when an individual's bond to society is weak or broken" (Akers, 1999, p.86). According to Hirschi (1969), Akers (1999) and Riley (2012), the four main elements or variables that constitute this bond are as follows:

- Attachment;
- Commitment;
- Involvement; and
- Beliefs.

In essence, the stronger these elements of social bonding with parents, adults, school teachers and peers, the more likely the individual's behaviour will be controlled in the direction of conformity. Likewise, the weaker the bonding, the more likely the individual will violate the law (Akers, 1999, p.86).

Akers (1999) describes the *attachment to others variable* as close affection ties to, admiration for and identification with others, which is underpinned by the caring factor about the expectation of others. Subsequently, the more insensitive people are to others' opinions, the less they are constrained by the norms which they share with them. As a consequence of their lack of attachment to others, the probability that they will violate those norms is extremely high.

The *commitment variable* mainly refers to the extent to which individuals have developed shares in conventionality or a 'stake in conformity' (Toby, 1957), which would be jeopardised by engaging in law violations or other forms of deviance (Akers, 1999, p.87). As pointed out by Akers (1999), appreciation and commitment to education and occupational careers will most probably enhance the commitment variable. Therefore, the greater the commitment, the less likely someone will commit a crime.

The *next variable, the involvement variable*, relates to a person's obsession in conventional activities, such as studying, spending time with family and participation in extra-curricular activities. Subsequently, most people with this obsession should be too busy and too preoccupied with the activities, resulting in less time to commit crime (Akers, 1999, p.87).

The *final variable* refers to the concept of belief and is defined as the endorsement of general conventional values and norms, which embraces the belief that laws and society's rules in general are morally correct and should be obeyed. Hence, the less a person believes he or she should obey the rules, the more likely he or she will eventually violate those rules (Akers, 1999, p87).

Hirschi (1969) and Akers (1999) suggest that in practical terms it is reasonably easy to measure the variables. For instance, they propose that parental supervision and discipline, good communications and relationships with others, and affection identification with parents and others could be used to measure attachment to others. Likewise, commitment could be showed by measuring both by educational aspirations (e.g. completing a degree) and achievement orientation. Akers (1999) asserts that commitment can also be measured by occupational activities and inspirations. Furthermore, involvement could be measured by observing engrossment in conventional activities, such as sports, recreational events, hobbies and time spent with friends. Finally, beliefs could be measured by noticing the extent to which a person respects the police and law, believes that the law should be obeyed, and the importance of education (Akers, 1999, p.88).

Akers (1999) states that social bonding theory utilizes similar dependent variables as for other crime theories (e.g. crime, delinquency and deviance). He also states that empirical tests on social bonding theory measure these variables in the exact same way (official or self-reported data) as in the case of other theories. Moreover, Akers (1999) highlights that the social bonding theory has received modest verification from empirical research, see Hindelang, 1973; Johnson & Johnson, 1979; Wiatrowski et al.,1981; Agnew, 1985; Cernkovich and Giordano, 1992; Rankin and Kern, 1994. These research projects have noticed moderate relationships between social bonding and deviant behaviour (Akers, 1999, p.90).

No research project which investigates the relationship between social bonding theory and organised crime could be found. However, social bonding theory was applied in a relative similar environment by Sims (2002) with the title '*Ethical Rule Breaking by Employees*'. This research project exemplifies the potential of social bonding theory to understand deviant and criminal behaviour. The researcher focuses on how modern managers could understand

and predict deviant behaviour of employees, such as dishonesty, cheating and stealing from employer. In doing so, Sims (2002) performed a survey on a sample of 200 employees in small and medium sized services and manufacturing firms to demonstrate that social bonding variables of attachment, commitment and involvement can be used for scrutinising ethical rule breaking by employees. The results of this study suggest that attachment and involvement variables are well suited to explain deviant behaviour of employees, while the commitment variable is less suited. Sims (2002) further proposes that the intention of staff to leave the organisation is not an effective measure of commitment, and therefore other measures to determine affective commitment are proposed for future research projects.

Sims (2002) defines employee deviance as "voluntary behaviour that violates significant organisational norms and in so doing threatens the well-being of an organisation, its members or both" (Sims, 2002, p.101). He also categorises employee deviant behaviour into three dimensions, namely property deviance, production deviance and political deviance. Property deviance includes embezzlement, theft, fraud, vandalism, sabotage and so forth. As highlighted in the previous chapter, organised crime activities could also include embezzlement, theft and fraud, which make the study of Sims relevant to this project. Sims (2002) has applied the attachment, involvement and commitment variables as proposed by Hirschi (1969) and found that the attachment and involvement variables are best suited to explain and understand deviant behaviour (Sims, 2002, p.101). Due to the similarity in activities of the study conducted by Sims and organised crime currently under investigation, it is argued that attachment and involvement variables would be best equipped to explain criminal and deviant behaviour in an organised crime environment. Therefore, given the easiness of measurement of these variables and moderate verification of the theory from empirical research, it was decided to include the two variables in the list of selected variables.

3.4.3   Labelling Theory

The remaining social-psychologically oriented theory to be discussed is called the labelling theory. The labelling theory focuses on the informal and formal application of stigmatising, by means of deviant 'labels' or 'tags' by society on some of its members. Perceived negative societal reactions could lead to the development of negative self-conceptions and greater delinquent involvement (Adams et al., 2003, p.171). Stigmatising negative labels to persons is based on social characteristics, such as class and race. White & Perrone (2010) claim that the stigmatisation of individuals is based on three pillars, namely:

* How people are typified;
* How people relate to one another on the basis of the typification; and
* What the consequences are of the social processes.

In brief, they argue that public labelling may affect individuals' self-identity and transform them so that they see themselves in the light of the label (self-fulfilling prophecy). Deviancy itself can be the result of the interactive process between individuals and the criminal justice system, such as a police agency, whereby the intervention process could result in deviancy.

Furthermore, in this context deviance is not a quality of the act the individual had committed, but rather a consequence of the application of labels by others of rules and sanctions to an accused or perpetrator. Thus, the victim in this case is the individual to whom the label has successfully been applied (White & Perrone, 2010, p.73).

The main concept of this theory is based on the assumption that by applying a stigmatising label to someone, will most probably result in creating deviance or cause further deviance if a similar label has already been applied in the past (Akers, 1999, p.109; Adams et al., 2003, p.171; Newburn, 2017, p.231). Indeed, according to Akers (1999), those who are labelled as deviant are highly likely to take on the self-identity of a deviant or criminal person. White & Perrone (2010) and Carrabine et al. (2009) agree with Akers' assumption and summarise the social process into seven basic steps, namely:

- *A deviant act occurs (deviation from societal or legal norms);*
- *A public label is applied (by courts, teachers, parents and counsellors);*
- *Stigmatisation occurs (a blot on your record – a stain on your character);*
- *In response to this stigmatisation, a new identity is formulated (as a means of defence or coping with negative social reaction to oneself);*
- *The construction of a new identity is formed in accordance with the label bestowed upon the individual (living up to the content of the label);*
- *A commitment is formed to the roles and behaviour of the attached label (learning the behaviour and norms of the role identified in the label); and*
- *Longer term pursuit of a deviant career occurs as dictated by the labelling process (becoming a 'criminal' or 'delinquent').*

Moreover, White & Perrone (2010) claim that the social process is underpinned by two main constructs, namely, primary and secondary deviation. The primary deviation transpires when individuals engaged in deviant activities in their early development stage; usually for a variety of social, cultural and psychological reasons. At this stage, the individual does not fundamentally change their self-concept (psyches of the individual). Importantly, according to White & Perrone (2010), no change in identity has occurred during this stage and deviance is seen as nothing more than a passing event. However, secondary deviation occurs when an individual experiences a fundamental reorientation of his or her self-concept and ultimately their behaviour. This change is caused by the social reaction to primary deviation.

The main attention of the labelling theory is with the secondary deviation (White & Perrone, 2010, p.74). Adams et al. (2003) highlight that the secondary deviation is empirically measured and verified by the self-concept variable. The self-concept variable comprises both formal and informal labelling variables. The formal labelling variable reflects the extent to which offenders had been stigmatised by being formally processed through a social control agency or in contact with other social control agencies. Informal labelling variables, on the other hand, imitate labels produced by parents, teachers and peers. The underpinning concept of the latter variable is to identify negative labels that might highlight past deviant behaviour or predict future delinquency. These negative labels should best

reflect the perception of the individual from the perspective of the parents, teacher and peers. Description contrasting adjectives for the negative labels could include, among others, the following:

- Cooperative or troublesome;
- Good or bad;
- Conforming or deviant;
- Obedient or disobedient;
- Polite or rude; and
- Law-abiding or deviant (Adams et al., 2003, p.175)

Although empirical research has supported the predictive ability of labelling theory, a number of researchers questioned the suitability of both formal and informal labelling variables in the criminological field. Adams et al. (2003) have for this reason examined the suitability of labelling theory by studying data obtained from high school students' attitudes and behaviours regarding drugs and delinquency in Mississippi. The study population comprised juveniles who were held in two state schools. A questionnaire which includes questions based on both formal and informal variables was administrated in group settings.

The study had three major objectives and they are as follows:

- To test the validity of the semantic differential scale for measuring negative self-concepts;
- To determine the relative effects of informal and formal labelling on self-reported delinquency; and
- To determine the predictive powers of labelling variables in terms of general and serious delinquency and drug-related offenses.

The outcome of the study provided partial support for the hypothesis that juveniles who choose a greater number of negative labels for their self-concepts will report more frequent delinquent involvement. Furthermore, labelling variables were also significant predictors of general and serious delinquency, but did not predict drug-related offenses (Adams et al., 2003, p.171). The results support Akers (1999) explanation of the value of the label theory in terms of criminal and deviant behaviour. He also argues that informal labelling variables received more empirical support to analyse and predict delinquency. The reason offered for the superiority of informal labelling variables is due to the fact that they incorporate variables from social bonding and social learning theory (Akers, 1999, p.110). Based on Akers claims and empirical studies performed by Matsueda (1992), Triplett and Jarjourna (1994) and Adams et al. (2003), it was decided to include the informal labelling variables in the list of selected variables.

In summary, this section articulated the three major social-psychological oriented theories related to criminology, namely social learning theory, control theories and labelling theory. Social learning theory claims that criminal and delinquent behaviour is acquired, repeated and changed by the same process as conforming behaviour. This theory in criminology has focused on four major concepts

and variables, namely differential association, definitions, differential reinforcement and imitation. To the contrary, the control theory states that individuals with high self-control will be less likely to engage in criminal activities, while those with low self-control are more susceptible to commit crime. Control theory proposes four types of bonding to others (variables), namely, attachment, commitment, involvement and beliefs. Finally, the labelling theory is based on the assumption that perceived negative societal reactions lead to the development of negative self-conceptions and greater delinquent involvement. Labelling variables include both formal and informal labelling; formal labelling refers to tags obtained through contact with social control agencies, whereas informal labelling relate to tags generated by parents, teachers and peers. The next section describes the four criminology-related sociological macro theories.

3.5   Sociological Explanation for Crime

The three major social-psychological oriented theories were presented in the previous section. The corollary of the investigation was the identification of seven variables which are earmarked to be used for future investigating and comprehending of organised crime cases. This section is following on from the previous discussion and is focusing on the four major criminology-related sociological theories as identified by Akers.

Sociology can be dated back as early as the commencement of the nineteenth century. Both Auguste Comte and Herbert Spencer were the first sociologists that concentrated on formalised sociology as an academic subject. However, the real founders of sociology are Karl Marx, Emile Durkheim and Max Weber (O'Byrne, 2013, p.8; Beirne & Messerschmidt, 2011, p.106). The three classical sociological writers had many different viewpoints in terms of social structures, control and regulation; they, however, effectively paved the foundations for all contemporary sociological theories. Notwithstanding the different viewpoints, the three writers had a desire to understand the transformation from pre-industrial society to industrial society and from feudalism to capitalism (O'Byrne, 2013, p.16).

Each of the founding writers attempted to understand the driving forces behind the massive process of social change. According to Marx, the impetus for change was an economic system; for Durkheim, the stimulus for change was sociocultural orientated; for Weber, the motor for change was politically driven. Moreover, all three of them developed their ideas in an effort to understand the widespread social, economic, cultural and political transformation resulted by the industrial revolutions in Europe. Today, their combined efforts form the corner-stone and main contribution to the professionalization of sociology as an academic discipline (O'Byrne, 2013, p.11). Most, if not all of the post-modern sociological theories, are premised on the concepts of the three classic writers, such as the Neo-Marxist theory (O'Byrne, 2013, p.17).

Sociological criminology is built upon classic sociology and articulates criminological theories from the perspectives that see the causes of crime as stemming from social factors (White & Perrone, 2010, p.66). Hence, instead of investigating crime from an individual level, sociological theories aim

to understand the nature and occurrence of crime by analysing the structure of the society that cultivates and shapes culture and behaviour. Based on this methodology, sociologists and criminologists are both concerned with the relationship between situational factors, such as immediate opportunities and specific peer groups, and social structural factors, such as employment and educational patterns. Furthermore, Bartol & Bartol (2014) argue that variables, such as age, race, gender, socio-economic status and ethnic cultural affiliation have all shown significant value in study certain categories and patterns of crimes.

As pointed out in section 3.3, Akers recommends anomie/strain, conflict, Marxist and feminist theories as suitable sociological macro theories to investigate crime (Akers, 1999, p.6). Each of these theories is discussed in the remainder of this section and is organised as follows:

- A brief description of each theory;
- Identification of variables exerted for each theory;
- Case study; and
- Verification of variables for investigating organised crime.

3.5.1 Anomie/Strain Theory

As alluded to before, Emile Durkheim was one of the founders of sociological criminology and his analyses of crime and punishment had inspired other researchers, such as Merton, to explain criminals and delinquency from a sociological perspective (Beirne & Messerschmidt, 2011, p.106; Akers, 1999, p.119). Durkheim attempted to explain onerous societal questions about how order and stability could be restored during the industrialisation of France in the nineteenth century. He researched for sources of social order which promote lack of order and stability, subsequently manifesting in crime and deviant activities. Durkheim operationalized his sociological insights to the examination of two specific forms of deviance, namely suicide and homicide. Most importantly, he argues that the suicide rate of any society depends on the type and extent of social organisation and integration (Beirne & Messerschmidt, 2011, p.110).

Robert Merton applied the sociology of Durkeim to the condition of modern industrial societies, such as the US, and defined the initial anomie/strain theory. According to Merton, an integrated society maintains equilibrium between social structure (approved social means) and culture (approved goals). In this context, anomie is the form of societal mal-integration where a dissociation between valued cultural ends and legitimate societal means exist. Moreover, Merton argues that anomie theory hypothesizes that social order, stability and integration are conducive to conformity, while disorder and mal-integration produce strain or pressure on groups or individuals, resulting in criminal and deviant acts. Merton also claims that high rates of crime and delinquency amongst lower-class and disadvantaged ethnic groups could be explained as the lack of legitimate opportunities (Akers, 1999, p120).

Merton further identifies five modes of adaptation to strain, namely conformity, innovation, rebellion, retreatism and ritualism. He claims that conformity as a result of strain is the most common response, as individuals and groups accept the state of affairs and continue to strive for success within the restricted opportunities. To the contrary, he asserts that

innovation is the most common deviant response as individuals and groups maintain their commitments to successful goals and implement illegitimate ways and means to achieve them. He subsequently exerts the latter to explain the high rate of crime in the lower class of the society, which subjects it to high levels of anomie-induced strain (Beirne & Messerschmidt, 2011, p.115; Akers, 1999, p.120).

As stated by Beirne & Messerschmidt (2011), there are crucial parts of Merton's arguments which are based on assumptions that are unstated and unproven. For example, he claims that the norms and values of the middle-class are widely accepted across the US and some of his arguments for the theory are heavily based on this assumption. No empirical proof exists to back this statement. These shortcomings in Merton's anomie/strain theory have inspired Robert Agnew to delineate the general strain theory. He claims that it is possible to explain crime and delinquency with Merton's anomie/strain theory, but a revision is required that focuses on the individual and his or her immediate social environment. The general strain theory of crime and delinquency is based on a broader concept of strain, beyond that produced by the discrepancy between aspirations and expectations, to encompass several sources of stress or strain (Frailing & Harper, 2017, p.17; Beirne & Messerschmidt, 2011, p.118; Akers, 1999, p.131).

Agnew identifies three major sources of strain or variables, which could be used to explain criminal and delinquent actions. They include failure to achieve goals, removal of positive or desired stimuli from the individual, and exposure to negative stimuli (Frailing & Harper, 2017, p.17).

In terms of the *failure to achieve goals variable*, Agnew refers to goals as immediate, ideal and future goals. Examples of such goals can include adequate education, employment/occupation, dwellings and so forth. He argues that the reasons for failures are based on lack of opportunities, and individual inadequacies in abilities and skills. The result of this disjunction between aspirations and actual achievements therefore leads to deviance or delinquency, such as theft or assault.

With regards to *removal of positive or desired stimuli from the individual variable*, Agnew argues that the experience of an individual with stressful events can produce anomic feelings. Examples of this situation include the loss of a friend, serious illness or death of a friend or family member, and separation of parents. According to Agnew, the loss of the positive stimuli could lead to seeking of revenge or managing the loss by taking illicit drugs.

In relation to *the exposure to negative stimuli variable*, Agnew refers to other stressful life events that involve the confrontation of individuals with negative actions by others. Such stressful events include child abuse or neglect, criminal victimisation, verbal threats and insults, and negative relations with parents and peers. Each of these events can cause a negative emotion, such as anger, resentment, fear or despair, which subsequently will trigger an aggressive response.

Akers (1999) reports empirical support for Agnew's theory and refers to a number of studies (Agnew & White, 1992; Brezina, 1996) which claim that the various sources of the general

strain theory are positively related to delinquency and drug misuse. The outcome of these studies shows that the general strain theory fares better empirically than the original anomie/strain theory (Akers, 1999, p.133).

Although no empirical testing of the general strain theory in terms of organised crime could be found, a highly influential study of the theory was conducted by Aseltine et al. in 2000 at the Massachusetts-Boston Universities. The researchers examined the central hypothesis of the general strain theory – that negative emotion mediates the association between diverse measures of strain (anger and anxiety) and a variety of deviant behaviours (aggressive and nonaggressive delinquencies). The sample data came from a prospective study of stress, mental health and social adaptation during the adolescent and young adult years. The data was collected during a three-year period by means of confidential in-person interviews, and the total sample size amounted to 939 students.

In order to test the central hypothesis, the researchers defined four closely-related hypotheses, namely:

H1: The total effects of family conflict, peer conflict and negative life events on deviant behaviour will be strong and positive, such that higher levels of strain are associated with higher levels of deviance.

H2: The total effects of family conflict, peer conflict and negative life events will be explained by their indirect effects on deviant behaviour through measures of anger and anxiety.

H3: The meditational model linking strain with deviance through anger and anxiety will be observed for a range of deviant outcomes, including acts of violence, nonviolence delinquency and marijuana use.

H4: The associations between strain and deviance will vary by youths' levels of personal resources (mastery), social resources (family attachment) and social context (exposure to delinquent peers), such that stronger effects of strain on deviant behaviour will be observed among those with lower levels of mastery, self-esteem, parental warmth and greater exposure to delinquent peers.

The main dependent variable, as outlined in H1 and H2, is delinquency and the independent variables included, amongst other, sex, age, living standard, family status, family conflict, peer conflict and life events.

Although the study provides a comprehensive test for the general strain theory, the overall results provided limited support for the effectiveness of the theory for all types of delinquencies (Aseltine et al., 2000, p.270). The results provide noteworthy evidence to evince strain in the form of negative life events and conflict with family members is indeed significantly and positively related to adolescent deviance. Furthermore, the study also confirmed the role of anger in mediating the impact of negative events and troubled social relationships on some forms of adolescent misconduct. However, these correlations were only obtained for violent and aggressive delinquency and not for non-aggressive delinquency (Aseltine et al., 2000, p.270).

In terms of organised crime, it was highlighted in the previous chapter that organised crime encompasses both violent/aggressive and non-violent/aggressive criminal, deviant and delinquent behaviour. Furthermore, there is a significant relationship between strain and deviant behaviour that occurs during adolescence and early adulthood years as pointed out by the studies; most of these behaviour events resonate with a number of organised crime activities, such as damaging property, carrying a hidden weapon to persuade clients to repay their debts, getting into physical fights (brawls) and so forth. Therefore, based on the empirical test results of Aseltine et al. (2000) and others mentioned in this section, it was inferred to include all three variables in the list of selected variables.

3.5.2 Conflict Theory of Criminal Behaviour

The conflict theory relies heavily on the Marxian theory and overlaps with certain concepts of the labelling theory as discussed previously (Cullen, Myer & Adler, 2011, p.357; Beirne & Messerschmidt, 2011, p.189). The conflict theory views the whole process of law-making, law-breaking and law enforcement as a function of conflict and power disparities among social, economic and political groups (Akers, 1999, p.153). In this context, criminal behaviour is seen as an ongoing collective conflict amongst the respective groups.

According to Beirne & Messerschmidt (2011), one effective method of explaining the conflict theory is to compare and contrast it against the consensus theory. On the one hand, the consensus theory explains the content and operation of the law by referring to a broad common agreement in society on social and moral norms, as well as the common interests of all elements of society. As such, power and authority tend to be invested in persons with intellectual or moral capabilities – persons with knowledge and attentiveness to the public good and the national interest (Beirne & Messerschmidt, 2011, p.189; Akers, 1999, p.157).

On the other hand, conflict theory proposes that the law and criminal justice system primarily represents the interests and norms of the most powerful groups in society and neglects the larger society in general (Cullen, Myer & Adler, 2011, pp.357). Power and authority tend to be self-perpetuating of life that reflects inherent patterns of social, economic and political inequality. In this context, the law is enforced by the criminal justice system in a manner that unfairly labels and punishes the less powerful in society (Beirne & Messerschmidt, 2011, p.189; Akers, 1999, p.157).

Empirical validity of both the consensus and conflict theories can be found, albeit that it stems mostly from studies of the enactment of law, studies of public opinion on crime, studies of race, class, sex and age disparities in arrest, convictions and penalties, and so forth (Akers, 1999, p.157). Research conducted by Brunk & Wilson (1991), Vold and Bernard, (1986) and Lo (2003) provides empirical evidence for the effectiveness of the conflict theory in a general sense. However, according to Akers (1999), very little research exists to test and verify the conflict theory in terms of criminal behaviour. The main reason offered for this situation is the narrow range of crimes to which it can be applied in an accurate manner. Furthermore, most crime activities are intra-group related and are committed by members inside a logical (similar culture and social norms) group against one another, rather than

between different logical groups (Akers, 1999, p.157). The conflict theory has been utilized to explain politically and ideologically motivated crimes successfully. Akers (1999) further argues that the conflict theory is not well suited to explain a vast majority of crimes, such as murder, theft, burglary, rape, arson, white collar crime and organised crime.

For instance, it could be argued that the existence of organised crime groups is due to restrictions placed by the society, such as provision of illicit drugs. Drug addiction occurs in all groups of society and therefore this crime cannot be explained as simply behaviour incidental to group and cultural conflict. Furthermore, in a certain sense, organised crime groups are not in conflict with the interests and norms of the most powerful groups in society. The powerful groups tend to favour patterns of social, economic and political inequality, which is fully in line with the aims and objectives of most organised crime groups.

Additionally, Beirne & Messerschmidt (2011) agree with Akers to a certain extent by pointing out that crime cannot always be explained due to conflict between the criminal justice system and a marginalised group. They argue that the conflict theory is just an introduction of a political dimension in criminology and does not always explain criminal behaviour for all occurrences of crime (Beirne & Messerschmidt, 2011, p.197). Based on these viewpoints and limited empirical scope of the conflict theory, it was decided not to include any specific variables pertaining to the theory in the list of selected variables for this research program.

3.5.3 Marxist Theory

The conflict theory as discussed above, gained significant prominence in sociology and criminology in the 1960s with the focus on the criminal justice system that expresses the interest and norms of the most powerful multi-groups in society. In the 1970s, however, some of the conflict theorists began to shift their focus towards a Marxist perspective of crime, due to the lack of empirical evidence for the conflict theory (Akers, 1999, p.161). Examples of such theorists included, among others, Richard Quinney, William Chambliss, Anthony Platt, and so forth.

The Marxist perspective is based on the Marxian theory developed by Karl Marx and his colleagues during the late 1800s (Carrabine et al., 2009, pp71-73). Marxism states that although human beings make their own history, they do not do so entirely by their own choice. In most cases, it is due to struggle in different social classes and social relationships. Further on, the basic classes of conflict in capitalist societies are between those who own the means of production (bourgeois) and those who have no source of income other than their labour (proletarian) (Beirne & Messerschmidt, 2011, p.184).

The Marxist criminological theory is based on above Marxian theory in the sense that it explains crime and criminal behaviour from a capitalist elite perspective; it has many commonalities with the conflict theory in explaining both law and criminal justice (Carrabine et al., 2009, pp71-75). More importantly, it rejects the multi-group conflict argument and claims that the society comprises a two-tier society, namely the capitalists or bourgeoisie and proletariat or worker class. The underpinning concept of the Marxist theory is centred on capitalism as the major cause of crime (Carrabine et al., 2009, pp71-75). In Marxist

theory, the capitalists initially control the means of production as well as manipulate the legal and criminal justice system. The worker class has no power, and normally after a while they become organised for revolution, take power into their own hands, overthrow the government and destroy the capitalist economy. Thereafter, the worker class will establish a socialist system that will ultimately evolve into a class-free/crime-free communist system (Akers, 1999, p.162).

Despite the efforts of Quinney and other Marxist theorists to explain capitalism as the major cause of crime, many researchers criticised the empirical adequacy of the theory. Akers (1999) has argued that the theory is more representing tautological propositions and dogmatic ideology rather than stating a testable theory of law making and law enforcement. He further argues that much of the Marxist theory is based on the condemnation of Western democracies and a call for revolutionary action to overthrow the government of the day. Furthermore, Karl Marx published virtually nothing about criminal behaviour and many Marxist criminologists have long recognised that there can be no purely Marxist theory of crime (Akers, 1999, p.167).

Subsequently, it is very difficult to operationalize the variables of the Marxist theory in real crime cases, as it would require a direct comparison of real capitalist with real socialist societies; for instance, comparing and contrasting criminals in the US with criminals in Soviet Union (Akers, 1999, p.185). Equally, although organised crime activities are perpetrated in both capitalistic and socialistic environments, it would be difficult to measure variables, such as the level of dissatisfaction against a government. Any type of political dissent in a communist country would be against the law, whereas some expression of dissatisfaction is legitimate in western democracies. Moreover, organised crime offenders will most probably not be too dissatisfied with the government as they might follow a glamorous lifestyle. Hence, due to the difficulty in measuring the social, economic and political variables relating to capitalism, it was decided not to include any specific variables pertaining to the theory in the list of selected variables for this research program. Instead, it was decided to include one general variable relating to the financial status of offenders, or alleged offenders, as it can provide valuable insights to why criminals are committing these criminal acts.

3.5.4 Feminist Theory

The final theory to be considered from an organised crime perspective is the Feminist theory. Akers (1999) asserts that all the previous six theories are predominantly designed to explain only male criminality and have been tested predominately on male populations. As a consequence, the feminist approach was developed in the 1970s with the main purpose to highlight and emphasize the differences between men and women as both biological, as well as social concepts (White & Perrone, 2010, p.87). Furthermore, many advocates of feminist theory argue that certain parts of the preceded six theories may be useful, but neither one single theory, nor all six theories together combined, are capable of explaining female criminality or the male/female differences in crime (Leonard, 1982 in Akers, 1999, p.196). For this reason, a number of feminist theorists developed a unique explanation of crime and delinquency from a female perspective.

Feminist theory focuses on the patriarchal system; a system in which the rights and privileges of males are superior, and those of females are subordinated (White & Perrone, 2010, p.87). In this environment, females are more disadvantaged, restricted and controlled (Gardner & Gray, 2016, p.28). In addition, there are also gender disparities in the criminal justice system which reflect male dominance and restrictive female sex roles. Notwithstanding these gender disparities, research has highlighted that the gender of the perpetrator has little or no effect on the outcome of the criminal justice process (Akers, 1999, p.202). Many feminist theorists are in consent with these findings, but advocate that the existing theories of crime are not well suited to explain both delinquencies and serious crime committed by females (White & Perrone, 2010, p.87).

All of the feminist theories to date, have addressed two basic issues, namely, whether or not explanations of law violations committed by males can also be applied to those committed by females, and secondly what accounts for the high ratio of male-to-female crime rates (Newburn, 2017, p.325). One of the first feminist theories, Women's Liberation and Female Crime by Adler and Simon (1975), addresses both issues by arguing that social change is occurring to advance male and female roles and behaviour towards greater equality in the conforming context of education, occupation, family, politics, the military and the economy (Newburn, 2017, p325). They further claim that the greater equality also results in similar deviant, delinquent or criminal behaviour patterns, subsequently increasing the rate of females arrested when compared against male arrests (Akers, 1999, p.197).

Another prominent feminist theory, called the Power-Control Theory of Gender and Delinquency, was defined by Hagan in 1987. This theory explains the difference between male and female rates of delinquency by relating to patriarchal family structures, capitalistic economic system and differences in the social control of males and females. The power-control theory proposes that the patriarchal family system creates more delinquent boys and fewer delinquent girls (Akers, 1999, p.202).

In the late 1980s, many feminist theorists moved away from the traditional themes of female liberation and sex-role differentiation in the family setup, to a more acceptable theme of male power over women that focuses on crimes committed both by and against women. James Messerschmidt (1986) was one of the first theorists who exploited the new theme by defining a theory that explains crime from a feminist perspective. He claims that crime is caused by the combination of a male-dominated, patriarchal social structure and a capitalist economic system (Akers, 1999, p.200). Messerschmidt concludes that the criminality of women and the violent crime of lower-class men both result from their powerlessness, whilst corporate crimes and sexual crimes against women (e.g. rape) are the consequences of male power (Akers, 1999, p.200).

According to Akers (1999), the most common variables used to apply the feminist theory to explain crime are family structures, capitalistic economic system and culture differences. The *family structure variable* impacts the social reproduction of gender relations and as a consequence the social distribution of delinquencies. Typical values for this variable could include family controls that promote risk taking or risk aversive. In terms of *capitalistic*

economic system variable, Akers segregates the offenders or potential offenders in class positions. Two general classes, i.e. powerful and powerless, are used to typify values for this variable. In relation to *culture differences*, the variable could include values, such as offender is cultural trained to instruct other people, offender is cultural trained to receive and execute instruction, strong patriarchal family culture, strong egalitarian family culture.

Noteworthy, Akers (1999) highlights that feminist theory is still in its infancy stage and not many researchers are actively engaged in testing the hypotheses of the theory. Literature review in international credited journals, such as Criminology, has revealed that research projects on feminist theory are extremely restricted and in most cases, it is applied as a secondary theory. Mullins and Wright (2003) are one of few researchers who have tested one of the hypotheses of the theory in their research project called 'Gender, Social Networks and Residential Burglary'.

The research project concentrated on the nature and dynamics of residential burglary by focussing on the gender aspect. The researchers claim that residential burglary is predominantly conducted in group format, whereby the role played by gender is shaped by patriarchal forces. Furthermore, they claim that women who engaged in burglary tend to do so within the context of predominately male offending groups. They also investigated the working role typically adopted by the female burglars during the commission of their residential break-ins and highlighted that in many instances, female burglars were subservient to males (Mullins & Wright, 2003, p.814).

The researchers hypothesize that gender status quo, dominated by patriarchal notions of appropriate masculine and feminine behaviour, can constrain the range of opportunities available to women. The hypothesis was tested by sampling data from 105 active residential burglaries. From this larger sample, the researchers extracted 18 female offenders and 36 male offenders, matched approximately on age. Data was obtained through a structured formal interview. The main dependent variable was to determine the role of patriarchy in female behaviour while committing residential burglary. The independent variables included, among other things, age, race, motivation to commit the crime, person who introduced offender to burglary and persuasion of partners.

The findings of the study revealed that men offenders are typically introduced to burglary through same-sex peers, whereas women came to the offense through their boyfriends or partners. Furthermore, many females claim that they were bullied by their boyfriends into playing some role in residential burglary. In some cases, females were not even aware of the planned burglary until they arrived at the crime scene. The corollary of the study is that patriarchy does play a significant role in residential burglary and the feminist theory could be used to explain certain aspects of the role of women in such an offense.

As pointed out in chapter 2, the range of actors involved in organised crime activities is diverse and can extend beyond the core group members to include politicians, government officials and business people (Wright, 2006, p.49). Lyman & Potter (2004) agree with Wright, but hypothesize that a low percentage of actors involved in organised crime are female

offenders due to the inequality of employer opportunities. Notwithstanding the low percentage, the feminist theory could shed important light on not only why female offenders participate in organised crime, but also which criminal activities are more likely to be executed by them. Also, as highlighted by Akers (1999), there is a clear division in society between the dominant and subordinate groups, and feminist theory provides some explanation as to why certain female offenders participate in delinquent and crime activities. The author further suggests that the theory could be operationalized by conducting cross-cultural comparisons of societies with greater or lesser patriarchy and examines the differences in male and female patterns. Based on the analysis performed by Lynman & Potter (2004), it is expected that both male and female patterns would be identified by the independent variables as outlined by Akers (1999). Therefore, given the potential and moderate verification of the theory from empirical research, it was decided to include all three variables in the list of selected variables.

The four most important sociological oriented theories related to criminology, namely Anomie/Strain theory, Conflict theory, Marxist theory and Feminist theory have been scrutinised, with the main aim of identifying suitable variables which could provide intelligence regarding the criminal behaviour of perpetrators in an organised crime environment. Anomie/strain theory hypothesizes that social order, stability and integration are conducive to conformity of social norms, while disorder and mal-integration are favourable to crime and deviance. Anomie in this context refers to the lack of social regulation in modern society that promotes higher crime rate. The original anomie/strain theory has been revised by several researchers with the most notable revision being called the general strain theory. According to this revision, crime and delinquency are an adaptation to strain and included three sources or variables related to stress. It appears that all three variables have the potential to explain criminal behaviour in an organised crime environment. To the contrary, conflict theory explains crime as the behaviour of individuals engrossed in cultural and group conflict and is deemed not suitable to enlighten criminal behaviour within an organised crime setting. Equally, the Marxist theory focuses on the inherent contradictions of capitalist society as a source of law and criminal justice, as well as crime. Variables which implement the Marxist theory are difficult to measure, and empirical validation of the primary Marxist argument that crime is a problem in capitalism but not in socialism, is unfound or lacking. Finally, feminist theory of criminal behaviour explains criminal behaviour and criminal justice decisions from a male dominance and functioning perspective to support patriarchy by discriminating against women and reinforcing traditional female sex and family roles. The three identified variables pertaining to this theory have also been included in the list of final variables.

Having identified a number of social-psychological and sociological independent variables, the focus is now moving away from explaining the actions and behaviour of criminals to social interrelationships amongst group members. The next section does so by focusing on social networks and network characteristics.

3.6 Social Network

The first part of this chapter surveyed theories of crime with the aim of identifying complex human behaviour from an offender's perspective. A number of potential independent variables were identified that could be used to investigate and scrutinise organised crime cases. This section continues with this process by examining the group dynamics of offenders and more, in particular, network characteristics, network interrelationships and communication dynamics.

Wright (2006) asserts that although gang life is not the only way in which organised crimes are manifested, a distinctive gang culture does underpin many organised crime groups (Obokata, 2010, pp.1-6). Therefore, by considering gang and social network constructs may prove to be useful in furthering an understanding of organised crime organisations. Wright (2006) in this context defines organised crime gangs as a classified peer group that exhibits some durability, engages in criminal activity and has some symbolic representation of membership. Goldstein (1994) supports the definition of Wright and focuses on two important constructs to explain gangs in a criminal sense. The two concepts are social supports and social networks. The author refers to social support as the various types of support (i.e. assistance/help) that people receive from others and is generally categorised into three major classes: emotional, informational and instrumental (resource) support.

Scott & Carrington (2011) and Goldstein (1994) defines social networks in the context of gangs as having the linkages that a member develops with particular individuals both within and outsides the group boundaries. They add that a social network involves the social relations in which every person is embedded; also, the chain of persons with whom a given person is in actual contact, and their interconnection. Social support enhanced the social network by provision information, cognitive guidance, tangible resources and emotional sustenance (Goldstein, 1994, p.127). As a corollary of the importance of social support to the overall functioning of group activities, it would be prudent to include social support as an independent variable to scrutinise organised crime networks. In terms of group activities in the social network, Vaughan & Hogg (2014) list three (3) core concepts viz: roles, status and communication.

Vaughan & Hogg (2014) argue that roles in the organisation describe and prescribe behaviour and are specifically designed to differentiate between people in the group for the greater good of the group in general. Furthermore, they claim that general role differentiation in groups is between task specialist (the 'ideas' people, who get things done) and socio-emotional specialist (the people everyone likes because they comfort relationships in the group). In terms of organised crime, the Contingency and Cosa Nostra models, as articulated in the previous chapter, provide a comprehensive explanation as to the different roles in an organised crime group or organisation. These roles include, among others, management, soldiers, protection, specialised support functions, social support functions and end users who consume the illicit products or illegal services (Morselli, 2003, pp.401-402). As pointed out by Vaughan & Hogg (2014), roles are important to comprehend group behaviour; therefore, further studies of actual organised crime cases might prove that differentiation among the roles in an organised crime group are important to gain a better understanding as to how and why these groups operate. Hence, roles are included in the selected list of independent variables.

Moreover, Vaughan & Hogg (2014) stress that not all roles in a group context are equal; some have greater status than others. Typically, the highest status role in most groups is awarded to the leader. These higher roles have typically two significant properties, namely consensual prestige and a tendency to initiate ideas and activities that are adopted by the group. Also, status hierarchies in groups are dynamic and can vary over time, as well as from situation to situation. In certain disciplined groups, such as organised crime groups, status hierarchies often become institutionalised, so that individual members do not engage in ongoing systematic social comparisons (i.e. like the mafia organisation). In this case, members simply presume that particular role occupants are of higher status than their own role.

Noticeable, research in status hierarchies has found that the high-status roles almost always went to people who had higher occupational status (Berger et al., 1977; Wagner & Berger, 1985; de Gilder & Wilke, 1994; Ridgeway, 2001, reference in Vaughan & Hogg, 2014). Vaughan & Hogg (2014) exert the expectation states theory to explain this concept. They argue that status stems from two separate sets of characteristics, namely specific status characteristics and diffuse status characteristics. Specific status characteristics is certain attributes that relate directly to the ability of the member of the group to perform his or her task, e.g. being a good athlete in a sport team will increase the chances of that member to become the leader of the sport group (Sartore & Cunningham, 2009, p.293). Diffuse status characteristics, on the other hand, refer to attributes that do not relate directly to the ability of the member to perform his or her task, but rather refer to the member's status (positively or negatively valued) in the society, e.g. being wealthy (Sartore & Cunningham, 2009, p.293). The overall status of each member of a group is determined by the sum total of both specific and diffuse statuses. For example, a member of an organised crime group who has both high specific and diffuse statuses are very likely to be the leader of the group, and therefore the abilities to plan and order criminal offences.

Consequently, status as an independent variable is a strong indicator of a member's ability to initiate criminal activities. For this reason, the status variable is included in the list of selected variables.

Arguably, communication networks are the most important component of a social network. Without a good effective communication network, most members will be unable to conduct their respective roles and apply their status within the group (Sherif et al., 2012, pp.280-282). Communication networks could be formal or informal and regulate who can communicate with whom. Vaughan & Hogg (2014) highlight that an important factor of communication networks is the number of links to be crossed for one person to communicate with another person. Goldstein (1994) classifies the number of links or interconnections between persons as dyadic (two persons), triadic (three persons) or multiple connections. Vaughan & Hogg (2014) mention that up to date, most researchers conducted experiments on three-person, four-person and five-person communication networks to understand the dynamics of communication networks in general. Figure 3.2 depicts the different network topology as defined by Vaughan & Hogg (2014), Vladutescu (2012) and Borgatti et al. (2009); the dots represent positions or roles or people, and lines represent communication channels. The networks on the left are highly centralised and the ones on the right are highly decentralised.
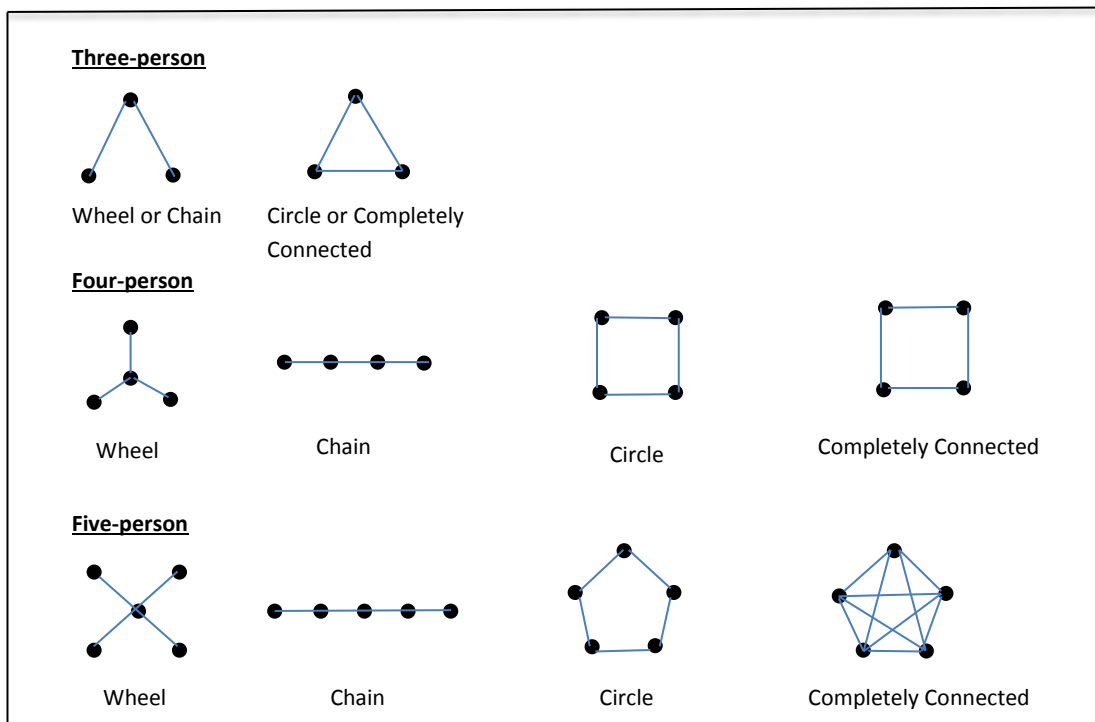
Figure 3.2: Communication Networks [Adopted from: (Vaughan & Hogg, 2014; Borgatti et al., 2009)].

According to Vaughan & Hogg (2014), for relatively simple tasks, groups tend to utilize centralised networks to improve group performance. In this configuration, the hub person (in most cases the leader) is able to receive, integrate and pass on information efficiently while allowing peripheral members to concentrate on their allotted roles. For more complex tasks, a more decentralised structure is implemented, as the quantity and complexity of information communicated would overwhelm a hub person. In this case, if centralised networks are utilized, it will most often lead to delays and miscommunication by the peripheral members. In an organised crime setup, communication between management and soldiers will most probably change depending on the task on hand. However, irrespective of which type of communication network is utilized within the organised crime group, the effectiveness of the network will play a vital role in the overall success of their activities. For instance, Bruinsma & Bernasco (2004) has revealed that organised crime groups operating in large-scale heroin markets tend to employ the wheel network structure due to their close-knitted, cohesive and ethnically homogenous nature. The researchers also publicise that organised crime groups that are active in trafficking of women have normally a chain structure, while those that operate in the market for stolen vehicles are characterised by three layers of circle structures combined with a single chain structure. Therefore, as could be established from preceded examples, communication network structure, as an independent variable, would seem to provide valuable information about the organised crime operations.

Another important consideration when analysing group communication is the degree of autonomy felt by group members (Kiesling & Paulston, 2008, p.11). Typical in a centralised communication structure, the hub member has normally more power, is less restricted and fully independent, compared to the peripheral members. To the contrary, in less centralised networks, members are

more autonomous and have a greater sense of job satisfaction, harmony and solidarity (Vaughan & Hogg, 2014, p.273). As highlighted in the previous chapter, commitment to the organised crime organisation is one of the main requirements for membership, e.g. to become a member of an outlaw motor cycle gang, street gang or criminal syndicate. Consequently, by measuring the degree of autonomy of each member should provide a better understanding of the overall modus operandi of the group (i.e. centralised or decentralised network, who is making the decision, level of commitment to commit a crime, and so forth) as well as, considering each member's level of participation in illegal group activities (Paoli, 2002, pp.70-75). Thus, autonomy as independent variable is included in the list of selected variables.

The final consideration when studying communication networks as highlighted by Vaughan & Hogg (2014) is the type of communication media used in group communication. Communication media could range from simple informal verbal communications to sophisticated computerised social network written communications. Choo and Smith (2008) assert that organised crime organisation now has more virtual groups and teams than ever before, resulting in a lower requirement to have regular in-person meetings. Instead, according to them, they often use electronic communication channels and are often highly distributed without a centralised communication hub. Since computerised communications engender de-emphasis of status differences and more equal participation among all members in the organised crime, the value of knowing which communication media is used in an organisation, as well as with whom they communicate become, absolutely important and vital. For this reason, the communication media independent variable is also included in the list of selected variables.

Moreover, Borgatti et al. (2009) further elaborate on communication networks by assessing key characteristics of social networks. The researchers utilize comparisons between social networks and physical sciences to articulate a number of key network characteristics. Arguably, one of the most comprehensive research efforts on social network characteristics from a crime perspective was conducted by Goldstein in the US during the early 1990s. Goldstein (1994) identified fifteen (15) network characteristics that resonate with Borgatti et al. (2009) summary of social network characteristics. Importantly, Goldstein (1994) argues that each of them should be taken into account when applying the six independent social network variables in a delinquent group context. The comprehensive listing of social network characteristics includes the following:

- Density or integration: The extent to which members of network are interconnected. The more the member associates with other members, the denser is that member's network.
- Multi-strandedness: This characteristic is also known as role multiplexity. It refers to the number of different ways a focal member is linked to another network member.
- Links: The connection between two or more network members. Links may vary in intimacy, frequency, duration, source and role multiplexity.
- Size or range: The number of members constituting the network.
- Reciprocity: The degree to which the products of the network, such as social support, are reciprocally available and exchanged.
- Symmetry: The degree of balance of power, attraction or other network resource/product within a link.

- Intensity: The degree of commitment within a link.
- Homogeneity: The degree of similarity of network members on given significant characteristics.
- Reachability: The average number of links needed to connect two members by the shortest route.
- Clustering: The extent to which the total network is divided into distinguishable cliques.
- Dispersion: The range of sources from which network membership is drawn.
- Dominant sources: The single source or context from which most network membership is drawn.
- Level: The comprehensiveness of relationships within the network. Interactional, dyadic, group and global levels of social network relationships have been distinguished.
- Facets: Alternative ways of defining network relationships. They include degree of support, degree of conflict, distribution of power and the relative status of the particular relationship within the individual's more encompassing social network.
- Perspective: The alternative views different members (e.g. insiders, participants, observers, outsiders) may have of an interaction, relationship, group or network.

In terms of organised crime, each of these fifteen characteristics could provide significant intelligence of the group in a network perspective. For instance, symmetry could indicate the leaders or managers of the organisation, whilst size and density could portray possible penetration opportunities for law enforcement into an organisation. Each of these characteristics will be further elaborated on in the next chapter. Due to the enormous potential of analysing network characteristics to provide intelligence about organised crime groups, it has been decided to include network characteristics as a single variable in the list of selected variables.

The primary focus of this section was to search for unique interrelationship attributes in a group or organisational context, which can be ultimately used to comprehend and conceptualise organised crime in general. The three core concepts of modern social networks, as identified by Vaughen & Hogg (2014), were briefly articulated: roles, status and communication networks. Roles refer to patterns of behaviour that distinguish between different activities and events within the group and that interrelate to one another for the greater good of the group. Status relates to the consensual evaluation of the prestige of a role in a group/organisation or prestige of a group as a whole. Communication networks are a set of rules, which govern verbal and written communication between different roles in a group. The outcome of this section was the identification and formation of seven independent variables, namely social support, roles, status, communication network structure, autonomy, communication media and network characteristics. The next section synopses all the independent variables as identified in this chapter.

3.7   Applying Independent Variables and Interrelationships to Organised Crime

The core overarching constructs that underpin the basis for investigating and comprehending crime in general, and more in particular organised crime, have been outlined in the preceded five sections. With these constructs in mind, the researcher conducted an extensive research on various academic knowledge databases and journals with the prime objective to acquire a list of crime variables that could be utilized as baseline to investigate the organised crime phenomenon.

Subsequently, the outcome of the study has revealed no research project where the focus was explicitly on identifying a comprehensive list of independent variables of crime in general, let alone organised crime. However, on the contrary, a plethora of credible and reputable research projects exists whereby a few general and psychological variables were exerted to scrutinise criminal behaviour for a particular crime activity, i.e. extortion, drug trafficking, and so forth.

In the public sphere, the situation appears to be similar with the FBI (2016) identifying several general crime variables to measure the status of crime in the US on an annual basis. The variables predominantly relate to various population groups and regions affected by crime, as well as various categories of crime reported to law enforcement. Another important public study relates to the EU annual report on organised crime (Van Duyne et al., 2006, p.43). In the mid-90s, the EU has engaged in the collection and collation of data on organised crime activities committed in all EU countries by means of crime variables. The data is utilized to build up a profound knowledge base on the phenomenon which is then used by policymakers and law enforcement agencies to plan effective crime prevention strategies and policies, as well as normal operational activities (Van Duyne et al., 2006, p.44). The variables are general in nature and can be categorised under the following classes:

- Variables on the crime (e.g. type of crime, number of crimes, economic damage caused and modus operandi);
- Variables on the organised crime groups (e.g. name of group, structure and composition);
- Variables on organised crime suspects (e.g. surname and first name, function in the organisation, gender, nationality and place and country of birth); and
- Variables on victims (e.g. age, gender, nationality and status in the country).

Due to the apparent lack of a comprehensive list of empirical proven variables and the exigency for articulating an investigation platform for examining organised crime, the author of this project has compiled a novice table of independent variables, which are to be used in following chapters to mine information and knowledge on real organised crime cases.

In order to compile a scrupulous table, variables are borrowed from trustworthy criminal theories and existing public available FBI and EU crime reporting variables. In section 3.2, it was pointed out that criminologists and crime researchers exploit, among others, independent variables to understand, explain, prevent and change criminal behaviour; it was also highlighted that there are several sciences dealing with human behaviour. The most common classification of applicable sciences is: biological science, psychological science, social-psychological science and sociological science. As further highlighted in the previous four sections, social-psychological and sociological sciences could be applied to a criminal investigation by means of derived criminal theories and in particular to reconnaissance the organised crime phenomenon. A number of independent variables

have been identified, formulated and discussed in an organised crime context and these variables are now collated and summarised in the remainder of the section.

The selection nomenclature for selecting or culling the final variables is as follows:

- Selection criteria:

Van Duyne et al. (2006) offer three important selection criteria when selecting variables for crime investigation, namely practicality, compatibility and all-inclusivity. Consequently, only variables which are easily and practically measurable are to be considered for the extensive list of independent variables. For this purpose, variables are either measured by means of quantitative or nominal values. Also, all variables should be compatible to enhance the measurement of constant results, i.e. variables should have the same meaning when employed in a range of different organised crime cases. In simple research terms, any ambiguous terminology for describing variables is to be eliminated by using basic self-explanatory terminology, relevant to all substantive organised crime cases. Finally, a diverse range of variables is to be considered to provide a holistic (all-inclusive) overview of organised crime. Hence, the variables should portray important information about the organisation and individuals in the group, as well as intelligence related to criminal activities and catalytic agents that indirectly contribute to criminal events.

- Method of selection:

A systematic review process is adopted in the preceded sections to identify suitable variables for the purpose of investigating organised crime. The overarching theme governing this review process is the discovery of identifiers or possible predictors of which the measurements are readily available and have the potential to shed light on the organised crime phenomenon, in order to cultivate new knowledge for future model and framework developments.

- Findings of the literature review:

Typical dependent variables discovered during the literature review include, among others, the measurement of the environment in which the purported phenomenon is conducted, measuring the extent of the crime, measuring the impact of it on the communities, determining the causes and origins of the wicked crime and establishing factors that affect the volume and type of crime (FBI, 2012, p.2; Van Duyne et al., 2006, p.2; Morrison, 2002, p.2). Moreover, according to Bartol & Bartol (2014) and Akers (1999), each of these dependent variables could be enlightened by analysing demographic, social, economic and psychological independent variables related to the offender and/or group.

- Significance of findings:

In section 3.2, it was argued that four demographic variables, i.e. age, gender, race and IQ, are well-established and are used by most academic researchers to analyse trends in general crime. Based on the research findings, it is debated that each of these variables should as a minimum measure and describe the compilation of offenders and victims in the population

which are most likely to participate in or be affected by organised crime events. Other statistical variables, such as type of crime, weapons and relationship of victims to offenders are also explicated as important informers of the nature and extent of organised crime.

Section 3.4 revealed that social-psychological theories are well suited to explain the social behaviour aspects of criminals and subsequently the three major social-psychologically oriented theories were investigated, viz., social learning theory, control theories and labelling theory. The corollary of the investigation has discovered ten possible variables of which seven have been deemed suitable in terms of the selection criteria. It is envisaged that the seven selected social-psychological variables should record both the social characteristics that influence offenders, as well as the important social aspects of the group environment that directly and indirectly mould offenders, which are all an intricate part of the process of making deviance, delinquency, and organised crime realities.

Following on from the social-psychological variables, section 3.5 investigated the four most important sociological oriented theories related to criminology, that is, Anomie/Strain theory, Conflict theory, Marxist theory and Feminist theory. Twelve sociological independent variables were identified. However, only six are considered to be suitable for investigating organised crime due to the difficulty to accurately and consistently measure some of these variables. Notwithstanding these challenges, it is envisioned that the six selected variables should shed light on why the society could be an enabler for organised crime and how the individuals within the group are influenced by societal norms that ultimately lead to the commission of organised crime. For instance, the outcome of these variables could explicate why some communities have higher organised crime rates than other communities, why mature members of the society tend to join organised crime groups and so on.

Finally, section 3.6 focused on one of the most burgeoning topics employed by criminologists when investigating both general and violent crimes, namely social networks (Fox et al., 2017, p.4). Social networks in this context consider various unique interrelationship attributes in a group and organisational milieu to map important characteristics onto network structures. Seven social network variables are unearthed and deemed suitable for investigating organised crime based on the selection criteria. It is envisaged that these variables should assist with the complicated analysis of social relationships in organised crime networks, beyond basic individual and group attributes (as outlined by the social-psychological and sociological variables) by focusing on mapping substantive relationships between individuals. Furthermore, it is also envisioned that these variables should enlighten intelligence on how information and goods flow between members within the organised crime group and the external environment, as well as identifying important individuals within the organised crime network based on their social position.

Table 3.1 shows a summary of the distribution of independent variables in terms of the different sciences and criminal theories. The selected list comprises eight general variables, seven social-psychological variables, six sociological variables and seven social network variables. The table also encompasses a cross reference between variables and the holistic taxonomy as defined in the

previous chapter in order to link the different organised crime concepts and definitions with the respective variable.

The table constitutes the core of the analytical process adopted to analyse organised crime in forth coming chapters. Conversely, the initial usefulness of this table can be explained when studying the research project called, "Anatomy of Dark Networks: The Case of the Turkish Ergenekon Terrorist Organisation (ETO)" (Demiroz & Kapucu, 2012, p.271-295) and by applying the contents of table 3.1 to the case. As highlighted in section 2.7.3, this study scrutinises the structure of the ETO by using network analysis tools and court documents as the primary source data. The ETO is notorious for their terrorist, organised crime and clandestine army activities and is currently being banded by NATO as a secret organisation. The court document consists of 2455 pages and the two researchers conducted a content analysis on the indictment and recorded all the transactions between the suspects into a spreadsheet codebook.

The researchers exerted crime related attributes or variables, such as weapons, communications, date of interaction, type of activities and goal of relationships to record the interactions between suspects. As part of the coding process, they identified and investigated 86 suspects and recorded actions, such as sending, receiving, giving and taking documents, weapons or any other actions that are related to the crime. Based on the interactions, they managed to construct a network which was then used to infer and comprehend the terrorist organisation. One significant discovery they made was that the ETO has a concentrated structure which consist of a core and periphery group of actors. The core group has a strong connectedness with each other, whilst the density of the relationship gets lower in the periphery groups. By analysing the network structure, the researchers identified 12 core actors and formulated modus operandi for both core and peripheral actors (Demiroz & Kapucu, 2012, p.271-295).

Central to analysing the network structure was the development of recommended punishments or sentences for each of the actors, based on their involvement in the criminal activities as computed by the network measures (Demiroz & Kapucu, 2012, p.290). The case was still on-going at the time the finding paper was compiled and it is uncertain as to whether the recommended sentences were in-line with the final sentences of the judge.

Nonetheless, the case study as a minimum, points out the value of independent crime variables. Moreover, at least five of the selected variables in table 3.1 were also used by the researchers in their quest to comprehend and analyse the ETO. As alluded to by the researchers, the outcome of this research could prove to be very useful for the law enforcement in Turkey to counteract the terrorist group, as it was possible to map various previously hidden concepts of organised crime activities to easily understandable network maps and explanations. The results might also prove useful to other law enforcement agencies around the world in their anti-terror activities. Therefore, it could be concluded that this substantive case study highlights the initial potential of variables listed in table 3.1. The effectiveness of all variables is further analysed and discussed in chapter 6.

Ref No	Variable	Applicable Theory of Crime	Applicable Element of Holistic Taxonomy	Variable Applied to Organised Crime	Selection Options
1.	Age	General Crime Theories	Core Member – Management	Age of Manager when Committed Crime	Number of Years
				Age of Manager when Crime was Detected	Number of Years
				Age of Manager when Crime was Reported	Number of Years
				Age of Manager when Crime was Investigated	Number of Years
				Age of Manager when Arrested by Police	Number of Years
				Age of Manager when Prosecuted	Number of Years
				Age of Manager when on Trial	Number of Years
				Age of Manager when Convicted	Number of Years
				Age of Manager when Incarcerated	Number of Years
				Age of Manager when Released	Number of Years
			Core Member – Soldier	Age of Soldier when Committed crime	Number of Years
				Age of Soldier when Crime was Detected	Number of Years
				Age of Soldier when Crime was Reported	Number of Years
				Age of Soldier when Crime was Investigated	Number of Years
				Age of Soldier when Arrested by Police	Number of Years
				Age of Soldier when Prosecuted	Number of Years
				Age of Soldier when on Trial	Number of Years
				Age of Soldier when Convicted	Number of Years
				Age of Soldier when Incarcerated	Number of Years
				Age of Soldier when Released	Number of Years
			User of Illicit Products and Services	Age of User when Committed crime	Number of Year
				Age of User when Crime was Detected	Number of Years
				Age of User when Crime was Reported	Number of Years
				Age of User when Crime was Investigated	Number of Years
				Age of User when Arrested by Police	Number of Years
				Age of User when Prosecuted	Number of Years
				Age of User when on Trial	Number of Years
				Age of User when Convicted	Number of Years

				Age of User when Incarcerated	Number of Years
				Age of User when Released	Number of Years
2.	Gender	General Crime Theories	Core Member – Management	Gender of Core Manager	Male or Female
			Core Member – Soldier	Gender of Soldier	Male or Female
			User of Illicit Products and Services	Gender of User	Male or Female
3.	Race	General Crime Theories	Core Member – Management	Race of Core Manager	Caucasians (White), non-Caucasians (Black), Asian or Other
			Core Member – Soldier	Race of Soldier	Caucasians (White), non-Caucasians (Black), Asian or Other
			User of Illicit Products and Services	Race of User	Caucasians (White), non-Caucasians (Black), Asian or Other
4.	IQ	General Crime Theories	Core Member – Management	IQ of Core Manager	Low, Medium, High or Unknown
			Core Member – Soldier	IQ of Soldier	Low, Medium High or Unknown
			User of Illicit Products and Services	IQ of User	Low, Medium High or Unknown
5.	Type of Crime – Serious	General Crime Theories	Organised Crime Activities	Murder and Non-Negligent Manslaughter	Yes, No or Unknown
				Rape	Yes, No or Unknown
				Robbery	Yes, No or Unknown
				Aggravated Assault	Yes, No or Unknown
				Burglary	Yes, No or Unknown
				Larceny-Theft	Yes, No or Unknown
				Arson	Yes, No or Unknown
6.	Type of Crime – Non-serious	General Crime Theories	Organised Crime Activities	Simple Assaults	Yes, No or Unknown
				Forgery and Counterfeiting	Yes, No or Unknown
				Fraud	Yes, No or Unknown
				Embezzlement	Yes, No or Unknown
				Stolen Property	Yes, No or Unknown
				Offenses against the Family and Children	Yes, No or Unknown
				Sex Offenses	Yes, No or Unknown
				Drug Abuse Violations	Yes, No or Unknown
				Gambling	Yes, No or Unknown
				Vandalism	Yes, No or Unknown
7.	Weapon or Tool	General Crime Theories	Tools	Firearm all Types	Yes, No or Unknown
				Knifes or Cutting Instruments	Yes, No or Unknown
				Blunt Object	Yes, No or Unknown
				Personal Weapons (hands, feet or other body parts)	Yes, No or Unknown
				Explosives	Yes, No or Unknown

				Narcotics and Drugs	Yes, No or Unknown
				Computer Related Equipment	Yes, No or Unknown
8.	Relationship of Victim to Offender	General Crime Theories	Organised Crime Perpetrators and Organisational Structure	Family	Husband, Wife, Partner, Parents, Siblings or Other Family
				Outside Family but Known to Victim	Neighbour, Acquaintance, Employee/Employer, Friend or Others
				Offender not Known to Victim	Stranger
				Religion of Offender	Christian, Catholic or Others
				Religion of Victim	Christian, Catholic or Others
9.	Differential Reinforcement	Social-psychological Theories	Core Member – Management	Anticipated Rewards for Core Manager	Financial, Status or Others
			Core Member – Soldier	Anticipated Rewards for Soldier	Financial, Status or Others
			User of Illicit Products and Services	Anticipated Rewards for User	Financial, Status or Others
			Core Member – Management	Anticipated Punishment for Core Manager	Community Release Order, Imprisonment, Suspended Sentence or Others
			Core Member – Soldier	Anticipated Punishment for Soldier	Community Release Order, Imprisonment, Suspended Sentence or Others
			User of Illicit Products and Services	Anticipated Punishment for User	Community Release Order, Imprisonment, Suspended Sentence or Others
10.	Definitions	Social-psychological Theories	Core Member – Management	Core Manager's Attitude Towards Law and Order – Previous Convictions	Yes, No or Unknown
			Core Member – Soldier	Soldier's Attitude Towards Law and Order – Previous Convictions	Yes, No or Unknown
			User of Illicit Products and Services	User's Attitude Towards Law and Order – Previous Convictions	Yes, No or Unknown
11.	Imitation	Social-psychological Theories	Core Member – Management	Core Manager following Protocol and Terms of Engagement based on their Observation on other Core Managers	Yes, No or Unknown
			Core Member – Soldier	Soldier following Protocol and Terms of Engagement based on their Observation	Yes, No or Unknown

				of other Soldiers	
			User of Illicit Products and Services	User Patterns of Illicit Products and Services based on their Observation of other Users of similar Illicit Products and Services	Yes, No or Unknown
12.	Social Structure – Social Learning	Social-psychological Theories	Core Member – Management	Social Class of Core Managers	Proprietors, Workers or Jobless
			Core Member – Soldier	Social Class of Soldiers	Proprietors, Workers or Jobless
			User of Illicit Products and Services	Social of Users	Proprietors, Workers or Jobless
			Core Member – Management	Family Member of other Core Managers	Yes, No or Unknown
			Core Member – Soldier	Family Member of other Soldiers	Yes, No or Unknown
			User of Illicit Products and Services	Family Member of other Users	Yes, No or Unknown
			Core Member – Management	School Association with other Core Managers	Yes, No or Unknown
			Core Member – Soldier	School Association with other Soldiers	Yes, No or Unknown
			User of Illicit Products and Services	School Association with other Users	Yes, No or Unknown
13.	Attachment to Others	Social-psychological Theories	Core Member – Management	Openness to Communicate with other Core Managers	Low, Medium, High or Unknown
			Core Member – Soldier	Openness to Communicate with other Soldiers	Low, Medium, High or Unknown
			User of Illicit Products and Services	Openness to Communicate with other Users	Low, Medium, High or Unknown
			Core Member – Management	Fostering a Personal Relationship with other Core Managers	Yes, No or Unknown
			Core Member – Soldier	Fostering a Personal Relationship with other Soldiers	Yes, No or Unknown
			User of Illicit Products and Services	Fostering a Personal Relationship with other Users	Yes, No or Unknown
14.	Involvement	Social-psychological Theories	Core Member – Management	Manager – Participation in Sport	Low, Medium, High or Unknown
			Core Member – Soldier	Soldier – Participation in Sport	Low, Medium, High or Unknown
			User of Illicit Products and Services	User – Participation in Sport	Low, Medium, High or Unknown
			Core Member – Management	Manager – Participation in Hobbies/Recreational Activities	Low, Medium, High or Unknown
			Core Member –	Soldier – Participation in	Low, Medium, High or

			Soldier	Hobbies/Recreational Activities	Unknown
			User of Illicit Products and Services	User – Participation in Hobbies/Recreational Activities	Low, Medium, High or Unknown
			Core Member – Management	Manager – Involvement in Close Relationships (Husband, Wife, Partner, Parents, and so forth.)	Yes, No or Unknown
			Core Member – Soldier	Soldier – Involvement in Close Relationships (Husband, Wife, Partner, Parents, and so forth.)	Yes, No or Unknown
			User of Illicit Products and Services	User – Involvement in Close Relationships (Husband, Wife, Partner, Parents, and so forth.)	Yes, No or Unknown
15.	Informal Labelling Variable	Social-psychological Theories	Core Member – Management	Behaviour of Core Member-Management is Appraised by Peers	Cooperative, Troublesome or Unknown
			Core Member – Soldier	Behaviour of Core Member – Soldier is Appraised by Peers	Cooperative, Troublesome or Unknown
			User of Illicit Products and Services	Behaviour of User is Appraised by Peers	Cooperative, Troublesome or Unknown
			Core Member – Management	Attitude of Core Member-Management is Appraised	Good, Bad or Unknown
			Core Member – Soldier	Attitude of Core Member – Soldier is Appraised by Peers	Good, Bad or Unknown
			User of Illicit Products and Services	Attitude of User is Appraised by Peers	Good, Bad or Unknown
			Core Member – Management	Behaviour of Core Member-Management is Appraised by Peers	Conforming, Deviant or Unknown
			Core Member – Soldier	Behaviour of Core Member – Soldier is Appraised by Peers	Conforming, Deviant or Unknown
			User of Illicit Products and Services	Behaviour of User is Appraised by Peers	Conforming, Deviant or Unknown
			Core Member – Management	Behaviour of Core Member-Management is Appraised by Peers	Obedient, Disobedient or Unknown
			Core Member – Soldier	Behaviour of Core Member – Soldier is Appraised by Peers	Obedient, Disobedient or Unknown
			User of Illicit Products and Services	Behaviour of User is Appraised by Peers	Obedient, Disobedient or Unknown
			Core Member – Management	Behaviour of Core Member-Management is Appraised by Peers	Polite, Rude or Unknown
			Core Member – Soldier	Behaviour of Core Member – Soldier is Appraised by Peers	Polite, Rude or Unknown
			User of Illicit	Behaviour of User is	Polite, Rude or Unknown

			Products and Services	Appraised by Peers	
			Core Member – Management	Behaviour of Core Member-Management is Appraised by Peers	Law-abiding, Deviant or Unknown
			Core Member – Soldier	Behaviour of Core Member – Soldier is Appraised by Peers	Law-abiding, Deviant or Unknown
			User of Illicit Products and Services	Behaviour of User is Appraised by Peers	Law-abiding, Deviant or Unknown
16.	Failure to Achieve goals	Sociological Theories	Core Member – Management	Core Member – Management Failed to Achieve Educational Aspirations	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier Failed to Achieve Educational Aspirations	Yes, No or Unknown
			User of Illicit Products and Services	User failed to Achieve Educational Aspirations	Yes, No or Unknown
			Core Member – Management	Core Member – Management Unsuccessful in Securing Employment of Choice	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier Unsuccessful in Securing Employment of Choice	Yes, No or Unknown
			User of Illicit Products and Services	User Unsuccessful in Securing Employment of Choice	Yes, No or Unknown
			Core Member – Management	Glamorous and High Social Status Important for Core Member – Management	Yes, No or Unknown
			Core Member – Soldier	Glamorous and High Social Status Important for Core Member – Management	Yes, No or Unknown
			User of Illicit Products and Services	Glamorous and High Social Status Important for User	Yes, No or Unknown
17.	Removal of Positive Stimuli	Sociological Theories	Core Member – Management	Core Member – Management has Lost a Friend or Family Member	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier has Lost a Friend or Family Member	Yes, No or Unknown
			User of Illicit Products and Services	User has Lost a Friend or Family Member	Yes, No or Unknown
18.	Exposure to Negative Stimuli	Sociological Theories	Core Member – Management	Core Member – Management is/was in Conflict with Parents and/or Peers	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier is/was in Conflict with Parents and/or Peers.	Yes, No or Unknown
			User of Illicit	User is/was in Conflict with	Yes, No or Unknown

			Products and Services	Parents and/or Peers	
			Core Member – Management	Core Member – Management was Exposed to Child Abuse and/or Neglect	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier was Exposed to Child Abuse and/or Neglect	Yes, No or Unknown
			User of Illicit Products and Services	User was Exposed to child Abuse and/or Neglect	Yes, No or Unknown
			Core Member – Management	Core Member – Management has been Exposed to Verbal Threats and Insults in the Past	Yes, No or Unknown
			Core Member – Soldier	Core Member – Soldier has been Exposed to Verbal Threats and Insults in the Past	Yes, No or Unknown
			User of Illicit Products and Services	User has been Exposed to Verbal Threats and Insults in the Past	Yes, No or Unknown
19.	Family Structure Philosophy	Sociological Theories	Core Member – Management	Manager's Risk Profile	Risk Taking, Risk Aversive or Unknown
			Core Member – Soldier	Soldier's Risk Profile	Risk Taking, Risk Aversive or Unknown
			User of Illicit Products and Services	User's Risk Profile	Risk Taking, Risk Aversive or Unknown
20.	Capitalistic Economic System	Sociological Theories	Core Member – Management	Manager's Economic Status.	Powerful Social Class (Owns one or more properties), Powerless Social Class (Owns no properties) or Unknown
			Core Member – Soldier	Soldier's Economic Status	Powerful Social Class (Owns one or more properties), Powerless Social Class (Owns no properties) or Unknown
			User of Illicit Products and Services	User's Economic Status	Powerful Social Class (Owns one or more properties), Powerless Social Class (Owns no properties) or Unknown
21.	Family Culture	Sociological Theories	Core Member – Management	Manager's Family Culture	Strong Patriarchal Family Culture, Strong Egalitarian Family Culture or Unknown
			Core Member – Soldier	Soldier's Family Culture	Strong Patriarchal Family Culture, Strong Egalitarian Family Culture or Unknown
			User of Illicit Products and Services	User's Family Culture	Strong Patriarchal Family Culture, Strong Egalitarian Family Culture or Unknown

22.	Roles	Social Network Theories	Organisational Structure	Management	Yes, No or Unknown
				Soldiers (The actual achievers)	Yes, No or Unknown
				Protection	Yes, No or Unknown
				Specialised Support Function	Yes, No or Unknown
				Social Support Functions	Yes, No or Unknown
				End User Role	Yes, No or Unknown
23.	Status	Social Network Theories	Organisational Structure	Core Member Status - Management and Soldiers. (*Specific status refers to the ability of a member to actively contribute in crime activities. Diffuse status relates to state of wealth, occupation and race (white).*)	High (High specific and High diffuse statuses), Medium (High specific or High diffuse Statuses), Low (Both Low specific and diffuse statuses) or Unknown
24.	Communication Network Structure	Social Network Theories	Organisational Structure	Communication Structure between Core Members - Management	Centralised, Decentralised or Unknown
				Communication Structure between Core Members - Soldiers	Centralised, Decentralised or Unknown
				Communication Structure between Core Members - Management to Soldiers	Centralised, Decentralised or Unknown
25.	Degree of Autonomy	Social Network Theories	Organisational Structure	Degree of Independency for Management Members	High (Making decision and control flow of information), Low (Not part of decision making and has no control in the flow of information) or Unknown
				Degree of Independency for Soldier Members	High (Making decision and control flow of information), Low (Not part of decision making and has no control in the flow of information) or Unknown
26.	Communication Media	Social Network Theories	Tools	Method of Communication among Management	Verbal in-person, Verbal thru electronic media, Written on paper, Written thru electronic mail, Written thru social networks or Unknown
				Method of Communication among Soldiers	Verbal in-person, Verbal thru electronic media, Written on paper, Written thru electronic mail, Written thru social networks or Unknown
				Method of Communication between Management and Soldiers	Verbal in-person, Verbal thru electronic media, Written on paper,

					Written thru electronic mail, Written thru social networks or Unknown
			Organisational Structure: Language	Language of Communication among Management	English or Other
				Language of Communication among Soldiers	English or Other
				Language of Communication between Management and Soldiers	English or Other
27.	Social Support	Social Network Theories	Tools, Results and Organisational Structure: Resources	Provision of Resources – Management	Yes, No or Unknown
				Provision of Resources – Soldier	Yes, No or Unknown
				Type of Resources to be Provision - Management	Money, Vehicles, People, Properties, Businesses, Tools, or Others
				Type of Resources to be Provision – Soldier	Money, Vehicles, People, Properties, Businesses, Tools, or Others
				Frequency of Provision of Resources – Management	Weekly, Monthly, Yearly or Unknown
				Frequency of Provision of Resources – Soldier	Weekly, Monthly, Yearly, Unknown
28.	Network Characteristics	Social Network Theories	Motivation, Crime Activities, Tools, Generic Phases and Results	Density or Integration	Number of Links or Unknown. (A high number of links indicates dense network.)
				Multi-Strandedness	Number of Links with the same member or Unknown
				Duration of Interconnection	Hours, Days, Weeks, Months or Unknown
				Frequency of Interconnection	Numbers of Interconnections or Unknown
				Size or Range of Network	Number of Members or Unknown
				Reciprocity	Number of Times which a Member has Returned a Favour or Unknown
				Symmetry – Degree of Balance of Power	Number of Resources which Reside under Member or Unknown
				Intensity – Degree of Commitment	Frequency of Meetings between Members or Unknown
				Homogeneity	Member's Opinion Regarding Objectives of Group – Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree or

					Reachability	Number of Links which Connects Members or Unknown
					Clustering	Number of Cliques in Network or Unknown
					Dominant Resource	Money, Vehicles, People, Properties, Businesses, Tools, or Others
					Level of Relationships	Dyadic, Triadic, Multiple Connections or Unknown

Table 3.1: List of Selected Independent Variables.

3.8   Conclusion

This chapter has provided a brief introduction to criminological theories associated with crime and criminality in general. The aim of studying these theories was to identify suitable attributes or variables as it is known in criminological research, which can be exerted to gain a comprehensive understanding of organised crime activities and perpetrators.

As an introduction to the discussion on criminological theories, a number of general attributes or variables related to most forms of delinquencies, crimes and criminalities were briefly articulated. These variables include, amongst other, age, gender, race and intelligence quotient (IQ). Information about victims, crime and criminal justice were used to highlight the value of each of these variables. As a result, it was concluded that these four general variables could be extremely contentious; yet they remain arguably the best available variables, which are not directly related to any criminological theory, to explain crime and criminality in general.

Subsequently, the two most prominent grouped related criminological theory streams, i.e. social-psychological and sociological streams, were discussed. First, the three major social-psychologically oriented theories, namely Social Learning theory, Control theories and Labelling theory were briefly introduced. All of these theories hypothesize that crime can be scientifically investigated by comprehending how the thoughts, feelings and behaviours of criminals are influenced by the actual, imagined or implied presence of others. Following on, the four most prominent sociological oriented theories, that is, Anomie/Strain, Conflict, Marxist and Feminist theories, were also presented. In contrast to social-psychological theories, sociological theories aim to understand the nature and occurrence of crime by analysing the structure of the society that moulds and shapes culture and behaviour. The end result of both explorations was the identification, formulation and discussion of seven social-psychological and six sociological independent variables.

The final part of this chapter concentrated on unique attributes in a group or organisational setting, by examining the group inter-relationships dynamics of offenders and more in particular network characteristics, network interrelationships and communication dynamics. The three core concepts of modern social networks were also briefly articulated: roles, status and communication networks. The outcome of this section was the formulation of seven social network variables.

The next chapter continues to explore the core notions of this chapter, specifically the twenty-eight selected independent variables, by focussing on social network analysis concepts that are utilized for mapping the variables to mathematical models. It also concentrates on studying the theoretical foundations of network structure/dynamic behaviour and demonstrates how to calculate the various network measures. Finally, the independent variables, network structures and measures are applied to the substantive organised crime case presented in section 3.7 of this chapter.

Chapter 4

Network Science

CHAPTER 4

Network Science

This chapter focuses on:

- Articulating general network terminologies and network topologies;
- Describing basic measurements for the characterisation of networks and mapping of variables;
- Delineating visualisation techniques which can be used to communicate the results of network measurements; and
- Examining criteria to evaluate the results of the network measurements.

4.1 Introduction

As highlighted in chapters 1 and 2, during the last few decades a notorious criminal phenomenon has emerged that is so diverse, lethal and sophisticated that it is extremely onerous to examine and represent by standard criminal investigative criminology; it requires instead more innovative, holistic and state of the art methodologies, tools and approaches to comprehend, control and counteract the phenomenon (Bell & Congram, 2014, p.46; Alach, 2011, p.56 – 72; Wright, 2006, p.183 – 187; Morrison, 2002, p.1). According to Morrison (2002), these methodologies, tools and approaches should deliberate on individual and group behaviours and interrelationships. For this reason, the previous chapter has focused on social-psychology, sociology and social network theories as potential exploratory sciences, which could serve as an alternative for traditional criminal investigating methodologies, with the aim of identifying unique attributes for individuals and groups. As indicated through a substantive case study analysis, these attributes highlight significant individual and group behaviour and interrelationship intelligence, and could be represented in a criminological sense as independent variables. Twenty-eight independent variables were identified to sample, collate and depict various key elements of real organised crime cases, some of these variables were briefly applied to an actual organised crime case to highlight the potential for analysing and inferring organised crime scientifically.

Furthermore, as pointed out by Spinuzzi (2016) and Lawler (2010), organised crime investigation has become extremely time-consuming and complex, due to the opening of international markets, technology advancements and loosely affiliated crime groups. Further to that, although the operationalization of independent variables showed potential to enable researchers and criminal investigators to sample data manually from substantive crime cases in a methodical way, it is still

very complex, onerous and tedious to analyse and infer the data. In order to analyse, interpret and infer the data more effectively, researchers require sound theoretical and practical approaches and techniques based on a proven science.

4.1.1 Network Science

Network science is one such science which can be used to analyse, visualise and interpret the sampled data. It is a burgeoning, yet well-established science and can be dated back as far as 1736 (Lewis, 2009, p.1).   Network science, also known as the science of networks is, "*the study of the theoretical foundations of network structure/dynamic behaviour and the application of networks to many subfields*" (Lewis, 2009, p.6; Armstrong & McCulloh, 2010, p.2). The study of networks is heavily dependent on graph theory and mathematics, and has been used since the late 1960s to model, among others, social, biological and physical networks (Vitevitch, 2014, p.198). In terms of social networks, the science is predominantly employed to study the behaviour of human groups (Lewis, 2009, p.6). For this reason, it was decided to employ network science as the vehicle by which the variables can be operationalized to investigate organised crime cases.

Moreover, in the academic sphere, network science is nowadays commonly used to analyse a range of research topics, such as biological, technological, scholarly, or linguistic networks, to name a few (Vitevitch, 2014, p.197; Barabasi, 2012, p.14). For each of these studies, network science, in its basic form, contrasts, compares, and integrates techniques and algorithms developed in disciplines as diverse as mathematics, statistics, physics, social network analysis, information technology and computer science (Börner et al., 2007, p.537; Armstrong & McCulloh, 2010, p.2; Alderson, 2008, p.1047; Vitevitch, 2014, p.198). These techniques and algorithms are mostly utilized to construct mesh shaped structures, called networks. Each network encompasses many different distinct structural characteristics that influence network dynamics (Vitevitch, 2014, p.197). Ultimately, by analysing the structural characteristics allows researchers to identify and understand major connections, trends and patterns in data, information and knowledge (Sayama et al., 2017, p.112; Börner et al., 2007, p.539).

4.1.2 What is Network Science Research?

Network science is operationalized through a process called network science research; the process comprises four main activities and is depicted in Figure 4.1 (Börner et al., 2007, p.541). The process normally commences with the definition of a suitable hypothesis or research question (Step 1). For example, what are the critical attributes necessary for determining nodes and relationships of organised criminal activities? During the next step, a suitable dataset is collected or sampled systematically, and is represented and stored in a format that would promote efficient processing (Step 2). For instance, in terms of this project, it would be the sampling of datasets from court summary documents. In the penultimate step, network measurements are applied to the datasets by means of network analysis and/or network modelling (Step 3). During the final step, the results are presented and interpreted by the researcher (Step 4). This interpretation activity could encompass

further refinement, such as parameter and algorithm alterations, and possible re-running of sampling, modelling, measurement and visualisation (Börner et al., 2007, p.540).
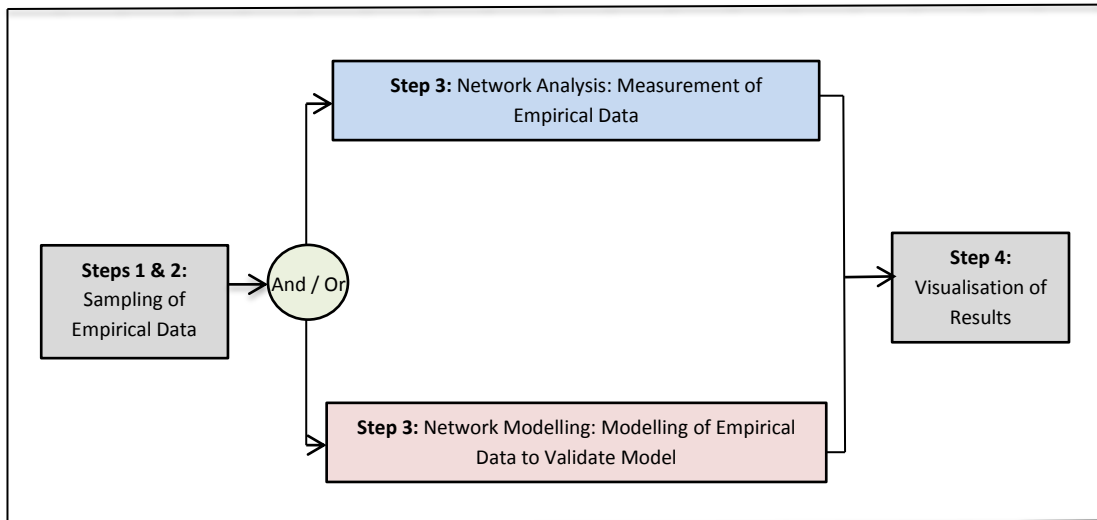
Figure 4.1: The General Network Science Research Process [Adopted from: (Börner et al., 2007)].

4.1.3 Network Analysis vs. Network Modelling

Noteworthy, there is a significant difference between network analysis and network modelling. The former aims at the generation of descriptive models which explain and describe certain system or incidence, whilst the latter attempts to design process models that can reproduce the empirical data as well as making forecasts (Börner et al., 2007, p.540). Hence, network modelling provides insights into why certain network structure and/or dynamic exist; especially when 'what if' scenarios are applied to the models. Importantly, researchers do not have to conduct both network analysis and network modelling tasks for every dataset. In most instances, it gets determined by both the complexity of the research case and exigencies of the researcher. In terms of organised crime, in one scenario, law enforcement officers might need to comprehend the structure of an organised crime syndicate in order to charge suspects and therefore they will execute network analysis task only. In another scenario, the officers might be interested in what will happen to the organised crime syndicate if the leader is eliminated. In this scenario, the law enforcers would need to proceed with both tasks in concurrence.

The aim of this chapter is to review network science by identifying and articulating the major network science concepts, terminologies and models relating to network analysis and network modelling, with the main aim to sample, measure, compute, visualise and interpret the measurements of the twenty-eight independent variables.

The chapter commences with a high-level introduction into basic network science notions, notations and terminologies that underpin the explanation of how network science could be exerted to implement the concept of independent variables. Next, the focus is on both standard mathematical and statistical measures to establish, analyse, scrutinise and comprehend the overall topology of the criminal network as constructed according to the independent variable measurements. This is

followed by an explanation of tools that is used to visualise network properties and network structures, as well as an articulation of a novel five-step exploratory approach which can be used to apply network science to real-case studies. The chapter concludes with the operationalization of the exploratory approach by applying it to the same substantive organised crime case, as in section 3.7.

4.2   Notions and Notations

This section provisions the necessary background required for the rest of this chapter and subsequent chapters to apply network science in a methodical and mathematical way and to equip the researcher and readers with contextual knowledge for analysing organised crime cases. This provisioning includes a definition of network science, brief introduction of the general principles of network science, algebraic definitions and notations of graphs, and matrix algebra definitions of graphs. It must be highlighted that the focus of this section is to provide a general review of network science; a detailed explanation of all definitions, concepts and equations is far beyond the scope of this chapter.

4.2.1   Definition of Network Science

Network science was briefly introduced in the previous section which included an official compact definition thereof. However, acknowledgement is given that it can be defined in many different ways as suggested by many astute authors (Lewis, 2009, p.5). As network science forms the nucleus of this research project, it is imperative to extrapolate and analyse a few key concepts related to the definition of network science. According to Lewis (2009), researchers should first study and understand the concept of a network before applying it to different disciplines.

The Committee on Network Science for Future Army Applications, commissioned by the US Board on Army Science and Technology in cooperation with the National Research Council of the US National Academics, articulates a network by referring to two main elements: *Structure* and *Behaviour* (National Research Council, 2005). Firstly, the structure element comprises network components, such as nodes and links which constitute the physical network. Secondly, the behaviour element refers to what the network does as a result of the interactions among the nodes and links. Based on this description, networks are always a representation or model of observed reality and are depicted as graphs that represent something real (Lewis, 2009, p.6; Vitevitch, 2014, pp.197-199).

The structure portion of a network is somewhat easily modelled by graph theory. In graph theory, the network itself can be defined in terms of a dataset, $G = \{N,L,f\}$, where N is a set of nodes, L is a set of links and f is the $N \times N$ mapping functions that defines the structure of G (that is, how the nodes are connected to each other through the links). To the contrary, the dataset G is inadequate to define the dynamic behaviour part of a network. For this purpose, micro-level rules are defined to govern the behaviour of nodes and links over a period of time. An example of micro-level rules could be the preferential attachment rule: links are attracted to nodes with magnitude of existing links.

Lewis (2009) argues that a complete definition of network G should include both structural and behavioural information. Thus, the dataset G should encompass nodes, links, mapping functions, micro-level rules and time aspects related to the dataset. Hence, a more complete definition of a network with its structural and dynamic behavioural elements could be denoted as follows (Lewis, 2009, p.7):

$$G(t) = \{N(t), L(t), f(t) : J(t)\} \qquad \ldots \qquad (4.1)$$

Where, t = time

N = nodes, also known as vertices or actors

f: N x N = mapping function that connects nodepairs, yielding topology

J = algorithm that operationalized the micro-level rules for describing behaviour of nodes and links over time.

Based on above comprehensive description of networks, it is now possible to delineate network science as the study of networks that includes both structural and behavioural elements. With reference to networks, network science for the purpose of this research project is defined as the study of the theoretical foundations of network structure/dynamic behaviour and the application of networks to many sub-fields, such as Social Network Analysis (SNA) and Life Science Systems (LSS) (Lewis, 2009, p.7). Moreover, network science in its basic form is essentially the science of systems, which models complex real-world phenomena, such as organised crime. Next, a number of important characteristics of network science are articulated that are related to the science of systems.

4.2.2 General Principles of Network Science

Lewis (2009) claims that researchers should comprehend eight general principles when analysing networks, such as social networks, market competition networks or physical and biological networks. The eight principles are as follows:

- Structure: Networks comprise structures that are not random collections of nodes and links. Many real-world phenomena behave the way they do due to their network structure. Therefore, network structures have the potential to explain individuals or group behaviour.
- Emergence: A network property is called emergent if it changes by a factor of 10 as a result of a dynamic network achieving stability. During emergence, a stable network transitions from one state to another until it reaches a fixed stable condition. Hence, emergence highlights the impetus or impact that causes movement or traction in networks.
- Dynamism: Dynamic behaviour is often the result of emergence or a series of small evolutionary steps leading to a fixed final stable condition. Dynamic behaviour normally reflects on the growth or variations of networks and must be comprehended in order to fully understand the intricacies of networks.

- Autonomy: In most cases, a network is constructed by the autonomous and spontaneous actions of independent nodes that freely come together, rather than through central control and planning. Also, the autonomous actions could eventually either lead to decay of the network over time, or adaption of the network to become a strong closely-knitted network.

- Bottom-Up Evolution: Networks normally grow from local level up to global level and not top down. Further on, due to the bottom-up evolution, most social networks are regarded as a distributed controlled network as a result of local rules being applied without a central body of control.

- Topology: The architecture or topology of a network refers to the network properties that emerge over time as a result of distributed autonomous behaviour of nodes. Topology in this regard refers to the structure of the network and is emerged from the force of preference attachment, unintended consequences, such as regulatory laws, or hidden orders of decentralised networks.

- Power: The power of the network is proportional to the number and strength of its nodes and links, and is calculated by means of betweenness or closeness equations. Metcalf's law states that the power of a network is proportional to the square of the number of nodes it contains, thus power = n(n-1)/2 = n². Power is an important network property as it indicates the most influential person in the group who performs most of the organisation's tasks.

- Stability: A network is deemed stable if the rate of change in the state of its nodes and links diminishes as time passes. Importantly, stable networks are more likely to function at their optimum performance.

4.2.3 Algebraic Definitions and Notations of Graphs

As noted before, graphs consist of *nodes*, *links* and a *mapping function* that defines how nodes are connected to one another. In static graphs, the properties of nodes, links and mapping function remain constant over time. To the contrary, in dynamic graphs the properties of nodes, links and mapping functions do change over time. This section focuses only on the most important properties of static graphs - nodes, links, mapping functions, degree of nodes, hub of graphs, paths and circuits, connectedness and components, diameter, radius, density and centrality of graphs, and betweenness and closeness of nodes (Newman, 2010, pp. 109-193; Lewis, 2009, pp.27-33; Börner et al., 2007, pp.538-545).

4.2.3.1 Nodes, Links and Mapping Function

Nodes (N) could be a set of actors, agents, persons, events, resources, knowledge, roles, locations, organisations, tasks, actions or beliefs (Vitevitch, 2014, p.198). *Links* (L) on the other hand is a set of defined relationships among the nodes (Vitevitch, 2014, p.198). Knoke & Yang (2008) identify *seven different types of relationships*, namely transactional related relationship (gift or exchange of physical items), communication related relationship (communication channels), boundary penetration related relationships (membership), instrumental relations (secure sales, valuable goods or provide advice), sentiment relations (affection or hostility),

authority/power relations (rights and obligations of actors to obey commands in organisations) and kinship or descent relations (bonds of blood or marriage). For instance, N may be the set of soldiers that work together in an organised crime group, and L may be the lines on the organisation chart of that group.

Graph G could be mathematically represented in terms of the nodes and links as follows:

$G = [N,L,f]$ ... 4.2

Where, $N = [v_1, v_2 \ldots\ldots v_n]$ are nodes

$L = [e_1, e_2 \ldots\ldots e_m]$ are links

f: L → N x N maps links onto node pairs.

Furthermore, graphs are categorised into two distinct groups – *Undirected graphs* and *directed graphs*. Undirected graphs are defined as graphs where the direction of linking between two nodes does not matter (Vitevitch, 2014, p.198; Lewis, 2009, p.27; Börner et al., 2007, p.542). Figure 4.2 (a) visualises the topology of the undirected graph G and the mapping function for this graph is as follows:

$f = [e_1: v_2 \sim v_1, e_2: v_2 \sim v_3]$ ... 4.3

In contrast, directed graphs are defined as graphs where the direction of the graphs is important and make a difference to the topology (Vitevitch, 2014, p.198; Lewis, 2009, p.27; Börner et al., 2007, p.542). Hence, a link defined for node v_1 to node v_2 is not the same as for node v_2 to node v_1. In reality, either or both links may exist in a directed graph. The direction of each link is distinguished by referring to one end of the link as the tail and the other end as the head (e_2: Tail → Head). Figure 4.2 (b) denotes the topology of a typical directed graph G, and the mapping function for this graph is as follows:

$f = [e_1: v_2 \rightarrow v_1, e_2: v_2 \rightarrow v_3]$ ... 4.4
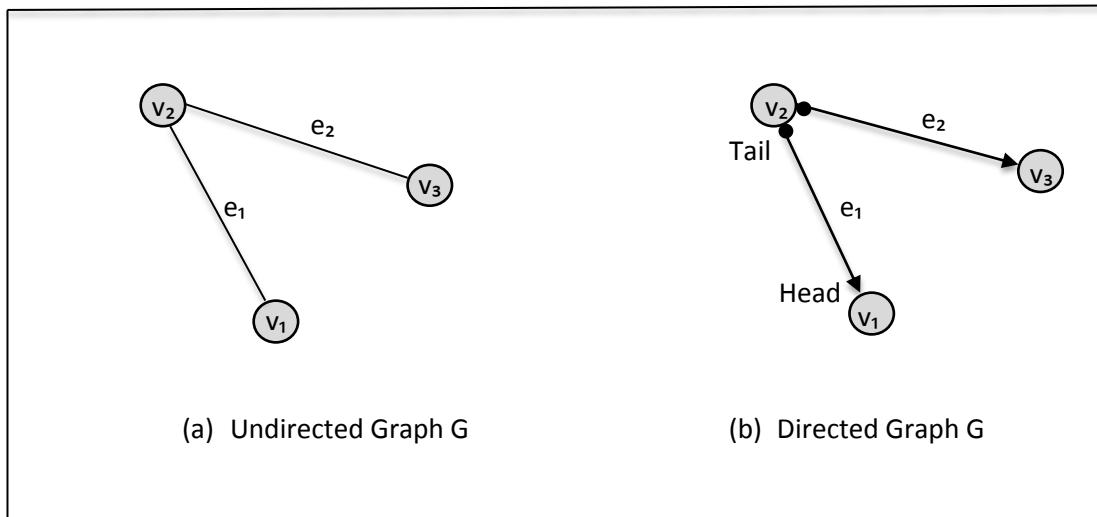
Figure 4.2: The Differentiation between Directed and Undirected Graphs [Adopted from: (Lewis, 2009)].

4.2.3.2 Degree of Nodes

Apart from the direction of each link, it is also important to determine the *degree of each node*. The degree of each node is defined as the number of links, directed or undirected, which connects a node with the rest of the nodes in the graph (Vitevitch, 2014, p.200; Lewis, 2009, p.27; Börner et al., 2007, p.544). It is represented as degree(v_i) or d(v_i) = $\sum_j e_i$ (equation 4.5). Hence for figure 4.2(a), the degree of node v_2 is 2 (or d_2 = 2) and for the other two nodes is 1.

Importantly, when the graph is directed, the out-degree of a node is equal to the number of outward-directed links and the in-degree is equal to the number of inward-directed links. With other words, out-degree is the number of tails and in-degree is the number of heads connected to a node. For example:

in_d(v_2) = in_d_2 = 0; and

out_d(v_2) = out_d(v_2) = 2.

4.2.3.3 Hub of Graphs

Another important property of graphs is the *hub of the graph*. The hub of a graph is the node with the largest degree. For instance, node v_2 is the hub of the graph in figure 4.2(a) and can mathematically be represented as follows:

Hub = maximum {$d(v_i)$}   …   4.6

Hub for Figure 4.2(a) = v_2

4.2.3.4 Paths and Circuits

Two other properties of graphs pertaining to the connection of nodes are *paths* and *circuits*. Paths are simply defined as sequences of connected nodes in graph G. For

example, if node u is connected to node v and node v is connected to node w, then by transitive closure, node u is connected to w. The mathematical representation of the graph for this example is as follows:

Connected(u,v) = true, if $u \sim v$; false otherwise   ...   4.7

Connected(u,w) = Connected(u,v) and Connected(v,w)

There are three important characteristics applicable to paths, namely length of a path, shortest path and average path. The *length of a path* is equal to the number of links between starting and ending nodes of the path. Path length t is measured in hops, thus the number of links along the path. For example, in figure 4.2(a) the length of the path from node v_1 to v_3 is $t = 2$. Conversely, in figure 4.2(b) the length of the path from v_1 to v_3 is $t = 0$, as e_1 and e_2 are directed links which do not allow for connection between v_1 to v_3.

The *shortest path,* or also known as the direct path, is the path with the least number of links between starting and end nodes. In figure 4.2(a), the shortest path from node v_1 to v_3 is $t = 2$. The *size of the graph* relates to the average shortest path lengths and is defined as the average value of all the shortest path lengths of all possible pairs of nodes. Also, the *average path,* or sometimes referred to as the characteristic path length of G, is defined as the average of all the direct paths between two nodes. It is computed by summing all direct paths and dividing them by the number of paths. The size of the graph and average path can be mathematically computed as follows:

Size of the Graph(G) $= \frac{2 \sum_{i=0}^{n} e_i}{n(n-1)}$ = hops   ...   4.8

Average path length of $G = \frac{\sum_{i=0}^{n} e_i}{n}$ = hops   ...   4.9

The Size and Average Path Length of Figure 4.2(a) = 1.33 hops.

A path that begins and ends with the same node is called a circuit. Based on this definition, connected(u,u) is true if a circuit exists from node u back to itself. Therefore, a loop is a circuit with a path length of 1, which means that node u connects to itself. Figure 4.3(a) depicts both a circuit (from node v_2 to v_3 and back) and a loop (from node v_3 to itself).

4.2.3.5 Connectedness and Components

Connectedness or reachability for undirected graph G is referred to be strongly connected if every node v_i is reachable along a path from every other node. Thus, a node is stated to be reachable from another node, if a path exists that connects the two nodes, even if it goes through multiple nodes in between. For instance, the graph in figure 4.2(a) is strongly connected. To the contrary, the graph in figure 4.3(a) is weaker connected as there is no path from node v_4 to any other nodes.

Components are defined as two or more unconnected sub-graphs, that is, graph G has components G_1 and G_2 if no undirected path exists from any node of G_1 to any node of G_2. Hence, in its simplest format, a component is an isolated sub-graph. Figure 4.3(b) exhibits a graph with two components, G_1 and G_2.

(a) Directed Graph G (b) Undirected Graph G
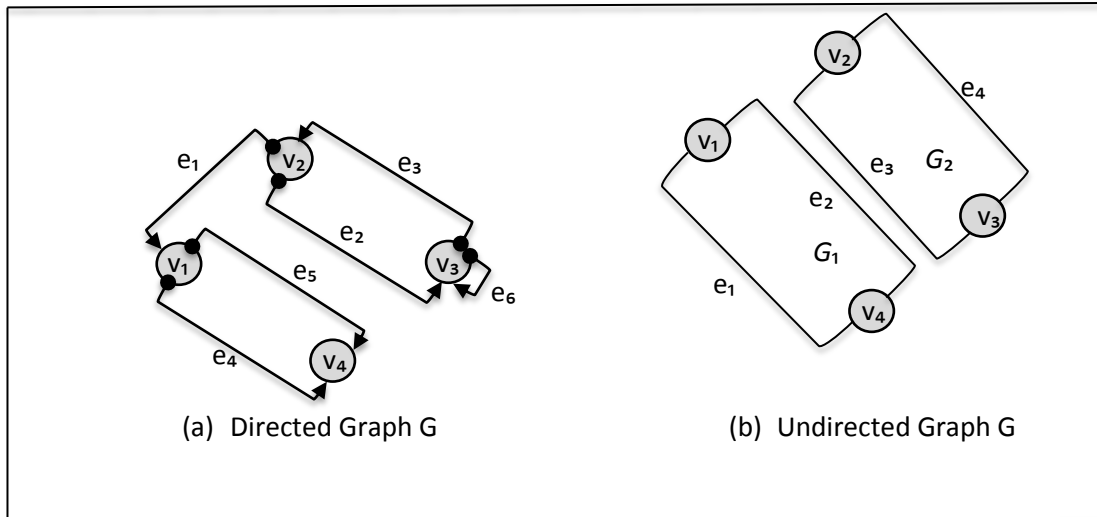
Figure 4.3: Directed and Undirected Graphs [Adopted from: (Lewis, 2009)].

4.2.3.6 Diameter, Radius, Density and Centrality

The three characteristics of path lengths are also used to articulate other properties of graphs, such as *diameter*, *radius*, *density* and *centrality*. The longest path between any two nodes in a graph G is called the diameter of G or denoted as diameter(*G*). It is important to note that there is no node farther away from all other nodes than the graph's diameter. The radius of a node *u* is defined as the longest of all the shortest paths from node *u* to all other connected nodes in the graph and is denoted as radius(*u*). The node or nodes with the largest radius are called peripheral or edge nodes. The density of the graph is defined as the ratio of the number of edge nodes in the graph to the square of the total number of nodes. If the number of edges in a graph is close to the maximum number of edges possible between all the nodes in the graph, then the graph is classified as a dense graph. If the graph has only a few edges, then the graph is categorised as a sparse graph. The centre of the graph is the node with the smallest radius. The mathematical representation to compute the density and radius of a graph is as follows:

$$\text{Density(G)} = \frac{\#\ of\ edge\ nodes}{(Total\ \#\ of\ nodes\ in\ Graph)^2} \qquad \ldots \qquad 4.10$$

$$\text{Or Density(G)} = \frac{Actual\ Links}{Potential\ Links}$$

$$\text{Radius}(u) = \text{maximum}_i\ \{\text{minimum}_j\ [\text{path}_j\ (u_i, v_i)]\ \} \qquad \ldots \qquad 4.11$$

The sequence of computation relating to path length determinations is to find all the paths between node *u* and the other paths. Next, record the longest of the short

direct paths as the radius of node u. Thereafter repeat the process for all nodes in the diagram. Then select the longest of all of the radii as the diameter of the graph. This is followed by selecting the centre of the graph by searching for the node with the smallest radius. Finally, compute the average path length as per equation 4.9.

For the graph in figure 4.4, the diameter(G) = 3, the centre of the graph is v_1 and v_2, and the average path length = 1.62 hops.
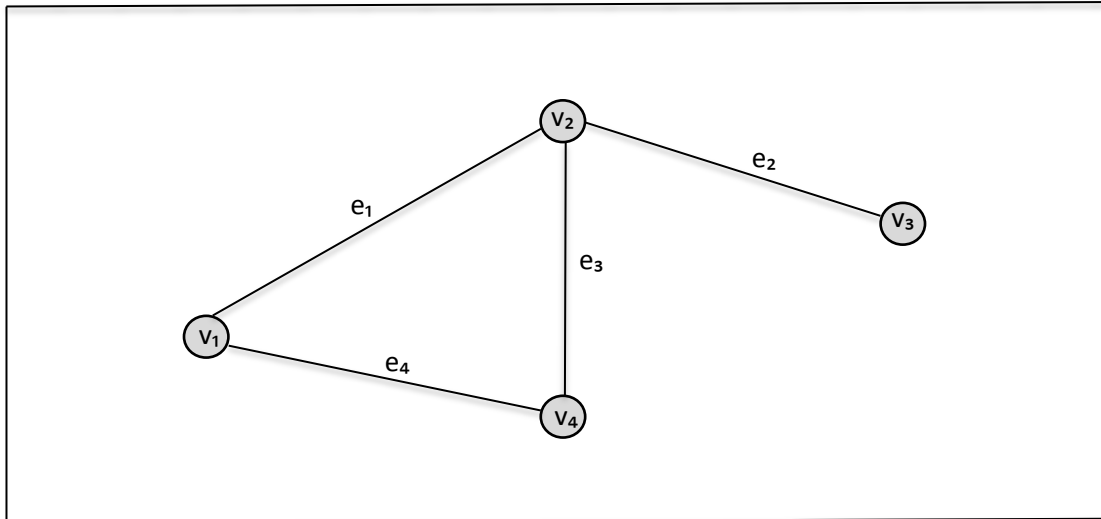
Figure 4.4: An Undirected Connected Graph, with no Loops, no Duplicated Links and One Circuit [Adopted from: (Lewis, 2009)].

4.2.3.7 Betweenness and Closeness

Betweenness of node v is the number of paths from all nodes, except v, to all other nodes that must pass through node v. *Closeness* on the other hand, is the number of direct paths from all nodes to all other nodes that must pass through node v. Further on, betweenness considers all paths, while closeness considers direct paths only.

Betweenness and closeness are both measures of the power of an intermediary. In figure 4.4, it is impossible to send a message from node v_1 to node v_3 without traversing through node v_2. In this case, node v_2 has power over v_1 and v_2 and is called an intermediary. Node v_2 has a desirable gatekeeper position and is normally a very powerful position in relation to the other nodes. The mathematical representation to compute closeness of node v is as follows:

$$\text{Closeness}(v) = \frac{1}{\sum_j d_{ij}} \qquad\qquad \dots \qquad 4.12$$

Where i is the focal node, j is another node in the network and d_{ij} is the shortest distance between two nodes.

4.2.4   Matrix Algebra Definitions of Graphs

A number of basic and regularly used properties and equations pertaining to graphs have been briefly introduced. Another popular and common form of analysing the properties of graphs is the delineating of matrix representations. Matrix representation, in particular, facilitates computerised storage and processing of graph properties that underpin the mathematical foundation for analysing the structure of the graph (Pinheiro, 2011, pp.29-31). Moreover, according to Lewis (2009), matrix representations are in many instances the most compact and efficient way to compute a property of a graph and will therefore be introduced next.

There are four basic forms of matrix representation, namely the connection, adjacency, Laplacian and path matrixes. Each of these matrixes is introduced next.

4.2.4.1 Connection Matrix

A connection matrix represents a mapping function of a graph, in the form of a square matrix containing the number of links between node pairs. The connection matrix in algebraic terms is denoted as $C(G)$, where C is simply a mapping function f expressed as a square matrix. In this matrix, rows correspond to tail nodes and columns correspond to head nodes of every link (k) in G. The n^2 elements of C are set to the number of links connecting tail and head pairs of nodes in G.

If more than one link connects two nodes, as illustrated in figure 4.3(a) nodes v_1 and v_2, then the number of links connecting node v_i to node v_j is inserted into row i and column j of C. Furthermore, the connection matrix is symmetric if the graph is undirected due to the fact that all links have heads and tails at both ends.

The connection matrixes $C(G)$ and $C(G')$ for the graphs of Figures 4.2(a) and 4.2(b), respectively, are as follows:

$$
C(G) = \begin{array}{c c} & \begin{array}{ccc} v_1 & v_2 & v_3 \end{array} \\ \begin{array}{c} v_1 \\ v_2 \\ v_3 \end{array} & \begin{array}{ccc} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{array} \end{array} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}
$$

$$
C(G') = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \end{array}
\begin{array}{ccc}
v_1 & v_2 & v_3 \\
0 & 0 & 0 \\
1 & 0 & 1 \\
0 & 0 & 0
\end{array}
=
\begin{bmatrix}
0 & 0 & 0 \\
1 & 0 & 1 \\
0 & 0 & 0
\end{bmatrix}
$$

4.2.4.2 Adjacency Matrix

The adjacency matrix is based on a socio-matrix that is used in social networks to analyse network properties. Social network analysis is more concerned with the existence of at least one relationship between pairs of people modelled as nodes in a graph, than how many relationships do exist. For this reason, loops and duplicated links are eliminated when analysing a socio-matrix (Lewis, 2009, p.34).

The adjacency matrix A is used in place of the connection matrix when the researcher aims to ignore duplicate links between node pairs and study the most basic connectivity of G. The adjacency matrix assumes k = 0 or k = 1.

Adjacency matrix representation is the most compact representation that captures the minimum topological information. For this reason, the adjacency matrix is used to represent network structure (Newman, 2010, p.283; Lewis, 2009, p.35).

Figure 4.3(a) can be used to depict the fundamental difference between connection and adjacency matrixes. The connection matrix $C(G)$ and adjacency matrix $A(G)$ for the graph of Figures 4.3(a), are as follows:

$$
C(G) = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array}
\begin{array}{cccc}
v_1 & v_2 & v_3 & v_4 \\
0 & 0 & 0 & 2 \\
1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0
\end{array}
=
\begin{bmatrix}
0 & 1 & 0 & 2 \\
1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0
\end{bmatrix}
$$

$$
A(G) = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array}
\begin{array}{cccc}
v_1 & v_2 & v_3 & v_4 \\
0 & 0 & 0 & 1 \\
1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0
\end{array}
=
\begin{bmatrix}
0 & 1 & 0 & 1 \\
1 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0
\end{bmatrix}
$$

4.2.4.3 Laplacian Matrix

The Laplacian matrix of graph G, or also known as $L(G)$, is a combination of the connection matrix and diagonal degree matrix. This combination can be presented as L = C − D, where D is a diagonal matrix and C is the connection matrix. Matrix D is a conformant matrix with zero non-diagonal elements and diagonal elements d_{ij} equal to the degree of node v_i:

$$d_{ij} = \begin{cases} degree(v_i) & if\ j=i \\ 0 & otherwise \end{cases} \qquad \dots \qquad 4.13$$

The Laplacian matrix is normally used to analyse the stability of a network. According to Barahona & Pecora (2002), the stability of the network can be determined by studying the eigenvalue (vector value) of matrix L. The smaller the variance of eigenvalues in the table, the more likely it would be that the network is stable. The connection, diagonal and Laplacian matrixes for the undirected graph of Figure 4.4 are as follows:

		v_1	v_2	v_3	v_4
	v_1	0	1	0	1
$C(G) =$	v_2	1	0	1	1
	v_3	0	1	0	0
	v_4	1	1	0	0

$$= \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$$

		v_1	v_2	v_3	v_4
	v_1	-2	0	0	0
$D(G) =$	v_2	0	-3	0	0
	v_3	0	0	-1	0
	v_4	0	0	0	-2

$$= \begin{bmatrix} -2 & 0 & 0 & 0 \\ 0 & -3 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -2 \end{bmatrix}$$

		v_1	v_2	v_3	v_4
	v_1	-2	1	0	1
$L(G) =$	v_2	1	-3	1	1
	v_3	0	1	-1	0
	v_4	1	1	0	-2

$$= \begin{bmatrix} -2 & 1 & 0 & 1 \\ 1 & -3 & 1 & 1 \\ 0 & 1 & -1 & 0 \\ 1 & 1 & 0 & -2 \end{bmatrix}$$

From the above Laplacian matrix, it is noticeable that the variance of eigenvalues equals 2, which signifies a fairly stable network. If the value amounted to 0, it would be presumed that the network has emergent.

4.2.4.4 Path Matrix

The path matrix, denoted as $P(G)$, stores the number of hops along the direct path between all node pairs in a graph (Newman, 2010, p.152). It computes the lengths of shortest paths among all node pairs. Therefore, the elements of a path matrix are equal to the path length separating nodes, or zero if no path exists. For path matrixes, the diagonal elements of $P(G)$ are zero to eliminate loops from consideration, as well as duplicated links (Lewis, 2009, p,36).

The path matrix for the undirected graph of figure 4.4 is as follows:

$$
P = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array}
\begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \\ 0 & 1 & 2 & 1 \\ 1 & 0 & 1 & 1 \\ 2 & 1 & 0 & 2 \\ 1 & 1 & 2 & 0 \end{array}
= \begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 0 & 1 & 1 \\ 2 & 1 & 0 & 2 \\ 1 & 1 & 2 & 0 \end{bmatrix}
$$

As illustrated by above path matrix, the diagonal elements are all 0 and the off-diagonals contain the number of hops along a path connecting each node pair. For example, there are two paths between v_1 and v_3, but the minimum-length paths between these two nodes are stored only – two hops. Also, the diameter of this graph is three hops.

The path matrix can also be computed by considering the adjacency matrix (A). The following mathematical representation can be used to compute path matrixes:

$$P = \min (k = 1,2)\{kA^K\} = \min\{A, 2A^2\} \qquad \qquad \dots \qquad 4.14$$

Where k = path-length in hops and A = adjacency matrix

The path matrix for the undirected graph of figure 4.4 can be computed by applying equation 4.14, and is as follows:

$$
P = \min \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}
\begin{bmatrix} 0 & 2 & 2 & 2 \\ 2 & 0 & 0 & 2 \\ 2 & 0 & 0 & 2 \\ 2 & 2 & 2 & 0 \end{bmatrix}
= \begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 0 & 1 & 1 \\ 2 & 1 & 0 & 2 \\ 1 & 1 & 2 & 0 \end{bmatrix}
$$

This section presented a high-level introduction to network science and in particular to graph theory, where the focus was on exploring the most important definition of network science, general principles of network science, algebraic definitions and notations of graphs, and matrix algebra definitions of graphs. These concepts and equations are used in later chapters to analyse the complex structures of organised crime groups. However, before applying these concepts and equations, it is imperative to get a better understanding of network measurements and network topologies. The next section aims to provide further background on these aspects.

4.3   Network Measurements

Using the foregoing notions and notations related to graph and network theories, this section articulates how networks, such as social networks are analysed and inferred. Vitevitch (2014), Benzi et al. (2012) and Alderson (2008) claim that the process is underpinned by the determination and articulation of important structural characteristics of networks and the interactions among the components. Benzi et al. (2012) further highlight that social network analysers normally investigate questions, such as who is the most important node or edge in the network, which node has the most influence in the network, what is the level of communicability among the nodes, where is the weak points in the network, and so forth. Most of these questions get answered by computing different measures of centrality.

According to Börner et al., network examination is the methodical and systematic study of the properties of graphs, local measures and global measures. In the context of this description, local measures refer to the neighbourhood of a node, whilst the global measures denote the interconnected structure of the entire network. The properties of graphs have been discussed in the previous section and will only refer to when articulating both the local and global measurements. Both local and global measurements are described in more detail below.

Rinheiro and Reis (2011) assert that networks, such as social network, can be analysed by applying both mathematical and statistical methodologies. The mathematical methodology is normally used to perform social network analysis in terms of a deterministic study, measuring the network data based on algorithms that compute the relationships among nodes, and their respective strength, frequency, recency, direction, etc. This methodology studies all observations about a particular population, according to a specific subject of concern, such as organised crime. Statistical methodology, on the other hand, considers stochastic events about the relationship strengths in terms of distribution (Rinheiro & Reis, 2011, p.23; Börner et al., 2007, p.553). Further on, statistical analyses consider the observations of a sample of the population of concern.

Moreover, both mathematical and statistical methodologies are used to analyse social networks, and each of them describe certain aspects of social networks (Rinheiro & Reis, 2011, p.24). On the one hand, mathematical methodology is applied to compute the node/edge properties, local network measures and to establish the overall topology of the network. On the other hand,

statistical methodology is exerted to analyse the outcomes from the network analysis, the distribution, outliers, and so on (Rinheiro & Reis, 2011, p.24). The rest of this section is articulating the standard set of measures and statistical observables commonly used to analyse social networks.

4.3.1 Node and Edge Properties

There is a plethora of measurements that characterise node and edge properties (Hanneman & Riddle, 2005). However, Börner et al. (2007), Newman (2010) and Rinheiro and Reis (2011) highlight five important centrality/power measures that should be utilized to comprehend and analyse nodes and edges, that is, the Degree of a node, Bonacich power index, Eigenvector centrality, Closeness centrality and Betweenness centrality. Gomez et al. (2003) support Börner et al. suggestion to utilize centrality and power to characterise nodes and edges and assert that centrality and power are the most common measures used in sociology to analyse social networks. According to them, it is important to determine who can communicate directly with other nodes/persons, how close is the node/person of concern to any other nodes/persons and which nodes require an intermediary node/person to enable communication. Each of these key aspects of social networks will be briefly discussed next.

- The Degree of a Node

  The degree of a node is arguably the most basic indicator of the centrality of a node. As per the definition in section 4.2.3.2, the degree of each node is defined as the number of links, directed or undirected, which connect a node with the rest of the nodes in the graph (Vitevitch, 2014, p.198; Lewis, 2009, p.27; Börner et al., 2007, p.544). Thus, degree of a node measures the size of the neighbourhood of a node and can be computed by observing the number of non-zero entries for that node in its row or column entry in the adjacency matrix. Alternatively, it is denoted as degree(v_i) or d(v_i) = $\sum_j e_i$ (equation 4.5).

  This measure exhibits the level of exposure a node or person has relative to the rest of the network, and therefore indicates the *level of opportunity to influence* people in the network. In practical terms, all connections coming into a particular node represent the in-degree of centrality and all connections going out from a node represent the out-degree of centrality. In an organised crime environment, all offenders who make calls to a particular offender represent his/her in-degree of centrality and all offenders who receive calls from that particular offender represent his/her out-degree of centrality.

  Degree of a node has the potential to illuminate potential leaders (management) and followers (core members and users). As such, offenders who make calls to several other offenders can be viewed as potential leaders (management) and offenders who received calls from leaders can be seen as followers (soldiers). Also, offenders who make calls to soldiers and other non-organised crime members only, could be seen as users of illicit products and services.

- Bonacich Power Index

This measure is similar to degree of a node in the sense that it takes into account both in-degree and out-degree of centrality of a particular node. Significantly, it differs from degree of a node measure in that it also considers the degree of the nodes connected to that particular node. This meaningful difference allows for the measurement of how *powerful a node is in his/her neighbourhood/clique* (Börner et al., 2007, p.544). Hence, Bonacich power index is based on the assumption that both centrality and power are functions of the connections of the nodes in the neighbourhood. The more connections the node has in the neighbourhood and the higher the degree of the connected nodes, the more central is the node in the network. Equally, the fewer connections the rest of the nodes have in that neighbourhood, the more powerful the central node will be. In terms of organised crime, it could be used to determine the junior and senior members of management.

- Eigenvector Centrality

Eigenvector centrality, resembling Bonacich Power Index, illustrates the *centre of large cliques in terms of the overall network*, as well as which nodes or persons are connected to important nodes. Hence, this measure illustrates the importance, relevance or power of a node within the sub-group or network (Rinheiro and Reis, 2011, p.77). The measure is computed by summing all the shortest paths (geodesic path) from each node to all other nodes. Thereafter each node is weighted in terms of the results of all nodes. The mathematical representation to compute eigenvector centrality of node *v* is as follows:

$$\text{Eigenvector}(v) = \sum (Number\ of\ all\ shortest\ path\ from\ node\ v) \quad \dots \quad 4.15$$

The 1st eigenvector value is assigned to the node with the highest score to indicate that the node is more central to the main pattern of distances among all of the nodes. Similarly, the lowest eigenvector value is assigned to the node with the lowest score, indicating that a node is more peripheral. Thus, the eigenvector value highlights how central a node's neighbours are to the network.

- Closeness Centrality

Closeness centrality computes the distance of a node to all other nodes (Newman, 2010, p.181; Börner et al., 2007, p.544). As highlighted in section 4.2.3.7, it measures the number of direct paths from all nodes to all other nodes that must pass through the node of concern. Closeness centrality further refers to the estimated time a node or person in a network needs to hear information (effectiveness of group) and thus highlights the *indirect influence* of persons. It is used to determine the intermediary's power of a node (person) in the network that might have influence over others. Thus, a node with a high level of closeness centrality might mean that this node has a noticeable level of influence in the network.

The mathematical representation to compute closeness of node *v* is as follows:

$$\text{Closeness}(v) = \frac{1}{\sum_j d_{ij}} \qquad\qquad \ldots \qquad 4.12$$

Where i is the focal node, j is another node in the network and d_{ij} is the shortest distance between two nodes.

The result is normalised between 0 and 1. The value of 1.0 means that a node is very close to the other nodes and therefore has a high level of influence in the network. Conversely, the value of 0 means that a node is far from other nodes in the network and as a consequence has a low level of influence in the network.

- Betweenness Centrality
  Betweenness centrality is somewhat similar to the closeness measure in the sense that it measures influence of nodes or persons (Newman, 2010, p.185). It is predominantly used to measure *direct influence and control* by means of gatekeeping, controlling flow of information and liaison between sub-groups activities. Hence, the measure aims to articulate the position of a node in a network in relation to the flow of information that is used to control people or activities (Börner et al., 2007, p.544).

  Essentially, it can be measured by the number of paths from *all* nodes to all other nodes that must pass through the node of concern. By considering all nodes results in analysing how often a node of concern lies on the shortest path between two other nodes. Thus, a node with a high level of betweenness centrality might mean that this node has a noticeable level of influence in the network and at least can spread rumours that could have a positive or negative consequence to the network.

  The mathematical representation to compute betweenness centrality of node *v* is as follows:

$$\text{Betweenness}(v) = \sum (Number\ of\ shortest\ path\ through\ node\ v)/$$
$$(Total\ Number\ of\ shortest\ paths) \qquad\qquad \ldots \qquad 4.16$$

  The result of the calculation is standardised between 0 and 1, where 1 means the node lies on every shortest path and 0 means it lies on none of the shortest paths. Furthermore, 1 denotes a person with exceptional high influence on other people and organisational activities, whilst 0 represent a person with very low level of influence.

4.3.2 Local Network Measures

The measurements previously discussed are mostly employed to characterise node properties and to determine the strength of influence and power of each node in relation to the rest of the network; this subsection discusses commonly used local network measures that articulate the level of cohesiveness of the neighbourhood of a node (sub-graph) and the occurrence of specific patterns or structures. Sub-graphs, and in particular cohesive sub-graphs, are defined as subsets of nodes or persons among whom there are relatively strong,

direct, intense, frequent or positive ties (Wasserman & Faust, 1994, p.249). According to Börner et al., there are at least four methods to compute cohesiveness of neighbourhoods and specific patterns, namely, Clustering Coefficient, Motifs, Community Detection and Structural Equivalence.

- Clustering Coefficient

The clustering coefficient C indicates the extent to which neighbours of a particular node are connected to each other (Vitevitch, 2014, p.198). This measure is normally exerted to determine whether friends of a particular node are also friends of each other. As a result, it is also commonly used to identify the network topology: lattice, small world, random network or a scale-free network (Börner et al., 2007, p.547).

This measure considers sub-graphs of three nodes, each that are fully connected in a triangular shape. In this context, cluster coefficient generally is the ratio of the actual number of triangular sub-graphs to the maximum possible number of triangular sub-graphs. This measure could be applied to both the node and its immediate neighbourhood or to all nodes in the network. Cluster coefficient for a node is the ratio of the actual number of triangular sub-graphs possible for that node to the maximum possible number for that node. Cluster coefficient for an entire graph is the average over-all node coefficients.

The mathematical representation to compute the cluster coefficient for a node v is as follows:

Node Cluster Coefficient Cc(v)= 2c / degree(v)(degree(v) – 1)   …   4.17

Where:

V = node

C = links shared with neighbours

Degree(v) = degree of node

Degree(v) – 1 = links among neighbours of node v.

The mathematical representation to compute the cluster coefficient for the entire graph/network is as follows:

Graph (G) Cluster Coefficient CC(G)= $\sum_{i=1}^{n} \frac{Cc(v_i)}{n}$ …   4.18

Where:

G = Graph

Cc = Cluster coefficient of Node v_i

n = total number of nodes.

Both measures are normalised and bounded to be between zero (0) and one (1). Zero (0) means that none of the neighbours of the nodes are neighbours with other nodes and one (1) denotes that all the neighbours of all nodes are neighbours with all of the other neighbours (Vitevitch, 2014, p.203). Furthermore, the closer C is to one (1), the larger is the interconnectedness of the sub-graph or graph under consideration (Börner et al., 2007, p.550). A high value of CC (*G*) and Cc (*v*) indicates that a high cohesiveness among nodes/persons exists, which might proclaim that friends of each node are also friends of other nodes. Moreover, the values of CC (*G*) and Cc (*v*) could be used to identify a network topology. Typically, a regular lattice graph has a high cluster coefficient CC (*G*) and Cc (*v*), whereas random graphs has typically very low cluster coefficient CC (*G*) and Cc (*v*) (Börner et al., 2007, p.559; Lewis, 2009, p.61).

- Motifs

Most networks comprise myriad of small patterns, called motifs. Motifs are local patterns of interconnections that occur throughout a network with higher probability than in a completely random network (Börner et al., 2007, p.559). Motifs are used to determine or identify cliques, cut points, hubs and authorities.

  o A clique is a sub-group of three or more nodes, all adjacent to each other. In a clique, there are no other nodes that are adjacent to all of the members of the clique (Wasserman & Faust, 1994, p.254). Wasserman & Faust (1994) highlight the significance of cliques by stating that cliques consist of nodes/persons which are connected through dense, direct, reciprocated choice relationships. These relationships enable members to share information, create solidarity and act collectively. Furthermore, numerous direct contacts among all clique members exist, combined with few or no ties to the outside, which positions the group towards homogeneity of thought, identity and behaviour. According to Wasserman & Faust (1994), this type of sub-group is very prominent in terrorist organisations and criminal gangs.

  A clique in a non-directed graph consists of the largest number of nodes with ties to all other clique members; thus, a clique density is always equal to one. It is possible for a node to be part of another clique, which makes this node/person more powerful than the other members. In terms of organised crime, overlapping clique members should indicate core members of the organisation.

  When investigating organised crime cases, researchers or social network analysers could use less stringent definition of cliques to search for possible groups where a member was evicted from the group over time. This member could become an access point for law enforcement agencies to enter the organisation. Several quasi-clique detection methods are available, such as n-clique, n-clan and k-plex (Wasserman & Faust, 1994). The N-clique method allows the analyser to specify a maximum geodesic distance (n) for all members

of the clique. Every node must be no more than n-steps away from every other member, resulting in a decrease in group density. An n-clan method, on the other hand, allows the analyser to specify the maximal n-diameter for a sub-group. This form of a clique is similar to an n-clique in which all members are connected by paths of length ≤ n and every node is also a member of the n-clique. Finally, the K-plex method lets the analyser stipulate the minimum number of connections/ties that a node must have to other members. A simple example of where K-plex might be useful is where an organised crime group policy requires a 75% core management approval before the nominated soldier can commence with a certain crime. In order to devise if such soldier will receive the instruction, the network analyser could apply the n-plex method to satisfy the $\{(N \times 0.75) - k\}$ connections criteria.

- o Cut points

Cut point or boundary spanner bridges connect different clusters in the overall graph/network by having concurrent membership in overlapping groups. They are well-positioned to be innovators, since they have access to ideas and information flowing in other clusters. Consequently, they are well positioned to combine different ideas and knowledge, found in various groups, to implement them in new products and services.

Conversely, boundary spanners face more risk and could have to comply with contradictory requirements from the different groups. Furthermore, they are also the most likely nodes/persons to be targeted by law enforcement to temporary or permanently dismantle an organised crime network by disintegrating the network into many unconnected sub-groups.

- o Hubs and Authorities

Hubs and authorities are inter-related concepts used in sub-graph centrality. In general, hubs are nodes which point to a large number of authorities, and authorities are nodes with a large number of links pointing towards them. In terms of graph theory, hubs have a high out-degree characteristic, whereas authorities have a high in-degree characteristic. Hubs and authorities do not only control the flow of information (e.g. messages) in a network, but it also establishes the effectiveness of the network in relation to the quality and speed at which each message is traversed through the network. Hence, hubs and authorities are important structural characteristics that could be investigated by the law enforcement officers to regulate the effectiveness and efficiency of the network.

Figure 4.5 exhibits a directed graph with two hubs and three authorities.
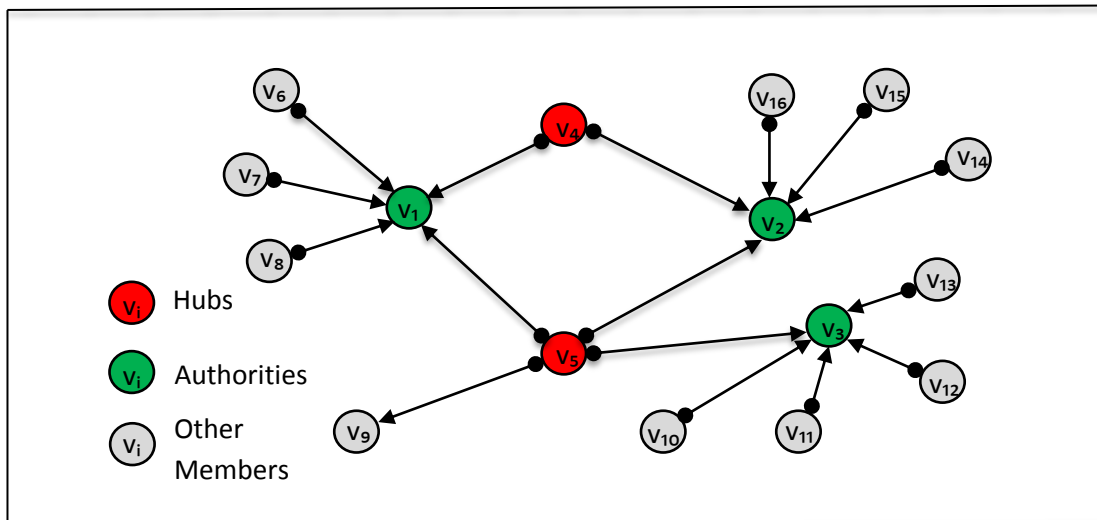
Figure 4.5: A Directed Connected Graph, with Two Hubs and Three Authorities.

- Community Detection

Community detection has its roots in graph partitioning and is concerned with the inter-connectivity among nodes, as it targets to identify groups of nodes that are highly densely connected to one another, relative to their neighbours. Consequently, the network can be segregated into series of modules, each being a separate entity comprising several nodes which performs an identifiable task, distinctly different from the tasks of the other modules. The characterisation of communities is particularly relevant when studying World-Wide Web where a large number of studies deal with the definition and measurement of directed sub-graphs (Börner et al., 2007, p.551).

There exist plethora of algorithms which can be used to identify communities, such as hierarchical clustering and non-hierarchical clustering algorithms. Both algorithms typically utilize attributed value information to cluster nodes. For example, the similarity of offenders might be appraised based on their hobbies and ages. Subsequently, nodes with similar hobbies and ages might be clustered as a community. An extensive explanation of these algorithms falls outside the scope of this project.

Börner et al. (2007) describe two simple and practical methods to identify communities. The first method is based on a mathematical technique to account for local cohesive groups by studying the number of bipartite cliques present in the graph. A bipartite clique $K_{n,m}$ identifies a group of n nodes, all which have a direct edge to the same m nodes. In terms of the World-Wide Web example, communities could be identified by searching for a group of fans with the same interest – fans who access the same Web pages of their idols (Börner et al., 2007, p.550-552).

Another method to detect communities is to look for sub-graphs where nodes are highly interconnected among themselves and poorly connected with nodes outside the sub-graph, in most cases connected via hubs and authorities. Also, in the community, each node has a higher density of

edges within the sub-group than the rest of the network. Figure 4.6 illustrates both methods; Figure 4.6 (a) pictures four fans and three idols and Figure 4.6 (b) displays a community of nodes (nodes v_1, v_2, v_3, v_4, v_5 and v_6) weakly connected to other nodes of the network.
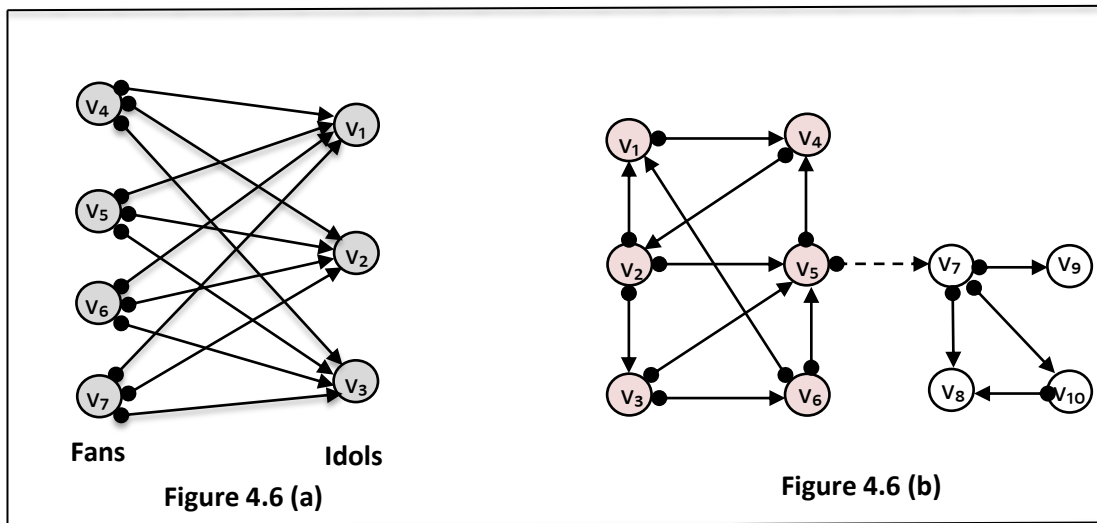
Figure 4.6: Community Detection [Adopted from: (Börner et al., 2007, p.551)].

- Structural Equivalence

  Structural equivalent technique focuses on finding sets of nodes that share similar structural properties, such as degree, clustering coefficient and betweenness (Vitevitch, 2014, p.203). Furthermore, it also concentrates on ascertaining information, such as whether neighbours of a node are connected and to whom, what nodes are reachable and in how many steps, what is the extent of the clique sizes and what is the path length to hub nodes (short paths is beneficial for information spreading) and so forth. The main reason for applying this technique is to take advantage of the fact that sub-networks of similar structure exhibit similar properties and support similar functionality.

  Structural equivalence is defined on three levels, namely:

  - Structurally equivalence – Two nodes have the same relationships to all other nodes in the network.
  - Automorphically equivalence – Two nodes are embedded in local sub-networks that have the same patterns of ties, that is, parallel structures.
  - Regularly equivalence – Two nodes have the same kind of ties with members of other sets of nodes that are also regularly equivalent (Börner et al., 2007, p.552).

  There exists a diverse range of approaches to determine the three levels of equivalence and they use popular measures, such as the Pearson correlation coefficient, Euclidean distances or Jaccard coefficient to determine the correlation between nodes. Most of

these approaches are included in contemporary social network analyser software packages.

4.3.3   Global Network Measures

As stated before, global measures are applied to analyse the interconnectivity structure and statistical properties of the entire network. These measures are predominantly exerted in the case of very large networks where the node/edge and local network measures are not sufficient to answer scientific or practical questions. In the case of small and medium networks, the measures could also be employed to articulate the over-all structure of the network of concern (Vitevitch, 2014, p.200).

In order to close the chasm of knowledge, global network measures are then used as aggregated measures of properties of the many elements that compose a network (Börner et al., 2007, p.553). Both Börner et al. (2007) and Lewis (2009) describe various global measures, some of which are articulated next.

- Graph Entropy

    Graph entropy is a measure of graph structure, and more in particular the lack of structure in a network. Entropy is a term borrowed for information theory, where it relates to a measure of the amount of information communicated by a message. The basic unit of information is the bit; therefore, entropy is the number of bits of randomness in a graph. The higher the entropy, the more random is the graph and network (Lewis, 2009, p.55). In practical terms, it means that the more random the network becomes, the more the uncertainty in the degree distribution sequence of messages, the less methodical the operational methods and more decentralised the structure will become.

    The mathematical representation to compute graph entropy for the entire graph/network is as follows:

    Graph Entropy I(G)= $\sum_{i=1}^{\max\_d} h_\text{i}\big(log^2(h_\text{i})\big)$ ...   4.19

    Where $g' = [h_1, h_2, ..., h_{\max\_d}]$

    h_1 = Fraction of nodes with degree 1

    h_2 = Fraction of nodes with degree 2

    $h_{\max\_d}]$ = Fraction of nodes with max_d = maximum degree (hub) of G

    Degree sequence G is the degree values of all nodes n in a graph G (g = [d_1, d_2, ... d_n].

    The higher the value of I(G), the more random the network is. As the value of I(G) decreases to zero, the corresponding graph's randomness also declines to zero.

- Average Centralities

Up to now the focus of centrality measures was to analyse the properties at a certain point or in a certain sub-group in a network. In order to comprehend the overall communication activities, the control of communication and efficiency of the communication in the entire network, it is imperative to compute the average degree, average closeness, average betweenness and average eigenvector centrality measures for a network.

o Average Degree Centrality

Average degree centrality measure calculates the overall density of the network. It measures the number of links present in a graph and compares it against the total number of possible links. The result is standardised between 0 and 1. The value of 0 means that there exists very low opportunity to directly influence the network, whereas a value of 1 means that a high opportunity exists to directly influence the network.

The mathematical representation to compute the average degree centrality for the entire graph/network is as follows:

degree(Network) or d(G) = $\sum \sum_{j=1}^{n} e_i$ / n(n-1)   …   4.20

o Average Closeness Centrality

The average closeness centrality measures the average length of geodesics within the network. The mathematical representation to compute closeness of nodes in a network is as follows:

Closeness(Network) = $\sum (\frac{1}{\sum_j d_{ij}})$/ n   …   4.21

The results are normalised between 0 and 1. The value of 1.0 means that all nodes in the network are very close to one another and therefore the network is deemed communication effective, allowing external persons to influence the network.

o Average Betweenness Centrality

This measure computes the average number of nodes per geodesic (shortest path) in the network. The mathematical representation to compute betweenness centrality of nodes in a network is as follows:

Betweenness(v)=$\sum[\sum(Number\ of\ shortest\ path\ through\ node\ v)/$
$(Total\ Number\ of\ shortest\ paths)]$ / n   …   4.22

The result of the calculation is standardised between 0 and 1. A high average betweenness value indicates that many nodes are on the shortest path in the network, while a low value reflects few nodes on the shortest path. Consequently, a high average betweenness value predicts a high level of control of information in the network, reducing the effectiveness of the network.

o   Average Eigenvector Centrality

The average eigenvector centrality measures connections between nodes to influential nodes in a network. High average eigenvector centralities mean that on average most nodes are connected to other influential agents. Likewise, low average eigenvector value indicates the existence of small elite (group of nodes) with influence in the network.

- Statistical Properties

A statistical study is normally conducted when the entire network is studied, rather than the characteristics of single nodes or sub-groups. An example of where these measures are prudent to use is to analyse the spread of computer viruses on the Internet (Börner et al., 2007, p.553). A statistical study is also useful to comprehend the dissemination of knowledge or innovations in a group context, such as organised crime by analysing the statistical distribution of graph properties. Next, four common statistical distributions are briefly introduced.

o   Node Degree Distribution

The degree distribution P(k) of an undirected graph is defined as the probability that any random chosen node has degree k. The average degree (k) of an undirected graph is defined as the number of all edges divided by the number of all nodes times two. With relation to directed graphs, both the in-degree $P(k_{in})$ and out-degree $P(k_{out})$ distributions are considered when defining the probability that a randomly chosen node has in-degree k_{in} and out-degree k_{out} respectively.

The standard method for measuring the heterogeneous or homogeneous property of networks is to study the moments of the degree distribution. Large fluctuations from the average degree distribution are indicative of heterogeneous networks, whereas small fluctuations suggest homogeneous networks. The second moment of the degree distribution k² determines how close the degree distribution of a network is to the average value of the distribution. Significantly, the variance is used to define different network types (Börner et al., 2007, p.554).

o   Degree Correlation Function

This measure is used to determine whether highly connected nodes are connected with other highly connected nodes (called assortative mixing) or with low degree nodes (called disassortative mixing). In mathematical terms, it can be computed by applying the average nearest neighbour's degree $k_{nn,j}$ of a node *i*.

$$\overline{k_{nn}} \,(k) = \frac{1}{N_k} \sum_i k_{nn,j} \; \delta_{k_i \, k,} \qquad\qquad \ldots \qquad 4.23$$

o   Node Betweenness Distribution

The betweenness centrality measure can also be statistically classified by considering the probability distribution $P_b(b)$ that a node has betweenness b. By comparing the average betweenness of the graph against the second moment of the distribution, provides insights as to the level of heterogeneity of networks for the betweenness property of nodes. The mathematical expression for the n-th moment of distribution (b^n) is as follows:

$$(b^n) = \sum_b b^n \; P_b(b) \; \equiv \; \frac{1}{N} \sum_i b^{n_i} \qquad\qquad \ldots \qquad 4.24$$

o   Average Clustering Coefficient

The average cluster coefficient is used by network analysers to comprehend whether a network has a modular or hierarchical structure on a global statistical level. They normally compute the clustering coefficient of smaller sub-graphs. The smaller sub-graphs are selected based on the same average degree distribution. The mathematical expression for the average clustering coefficient (C(k)) of nodes with degree k is as follows:

$$(C(k)) = \frac{1}{N_k} \sum_i C_i \quad \delta_{k_i \, k} \qquad\qquad \ldots \qquad 4.25$$
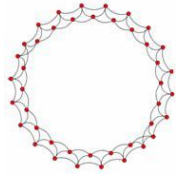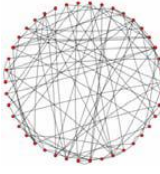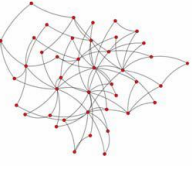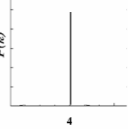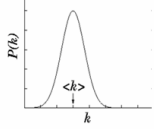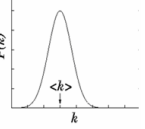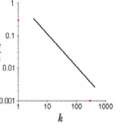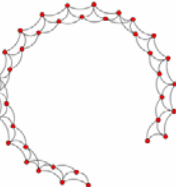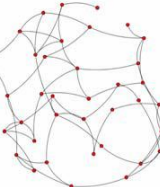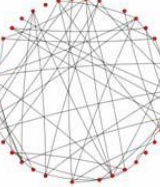
4.3.4   Classification of Network Types based on Network Measures

Various node, edge, local and global measurement properties have been introduced and articulated in the foregoing section. Next, the focus is shifting towards how these properties can be utilized to analyse the structural and functional properties of large networks. The aim is to search for large-scale regularities and asymptotic patterns that can explain the dynamics and evolution of complex networked systems (Börner et al., 2007, p.555).

There are many different types of networks, based on the structural and functional properties of the network; however, Börner et al. (2007), Alderson (2008) and Lewis (2009) define four major types of networks. These networks include Regular Lattice, Small-World, Random and Scale-Free networks. Börner et al. (2007) and Lewis (2009) have generated instances of each network for means of comparison and listed a number of distinct features for each network type. The scale free network was generated by using the Barabasi-Albert

model and the other three networks were generated by applying the Watt-Strogatz model. Explanation of each model is outside the scope of this document.

Börner et al. (2007) subsequently utilize seven network measures to exemplify and discuss the dynamics of the four different networks, namely Number of Nodes, Number of Edges, Diameter, Characteristic/Average path length, Clustering Coefficient, Average degree and General Degree Distribution. Lewis (2009) concurs with Börner et al. in terms of the selected measures, but suggests including also Hub Degree and Entropy network measures to deliberate the structural and functional properties of the different networks. Table 4.1 lists the properties of each network type as generated by Börner et al. (2007).

	Regular Lattice	Small-World	Random	Scale-Free
Layout				
# Nodes	42	42	42	42
# Edges	84	84	84	81
Diameter	11	5	5	5
Characteristic Path Length	5.6	2.9	2.76	2.6
Clustering Coefficient	1	0.31	0.21	0.26
Average Clustering Coefficient	0.5	0.16	0.13	0.22
Average Degree	4	4	4	3.86
General Degree Distribution	Delta	Poisson-like	Poisson	Power
After Removal of the Five Most Highly Connected Nodes				

Table 4.1: Network Measures Exemplified for a Regular Lattice, Small World Network, a Random Network and a Scale-free Network (Börner et al., 2007, p.558).

In a regular lattice network, all nodes have a degree of four, and hence the degree distribution has a Dirac Delta function at four. Both random and small-world networks have a poissonian degree distribution that highlights the homogeneous characteristic of the networks due to the fact that most nodes have approximately the same number of links

(Vitevitch, 2014, p.200). The degree distribution of a scale-free network decays as a power law P(k) ~ $k^{-\delta}$ at large k (Börner et al., 2007, p.559; Alderson, 2008, pp.1051-1053). The power degree distribution emphasizes the fact that the majority of nodes have one or two edges, but a few nodes have a large number of edges and act as hubs (Vitevitch, 2014, p.200; Börner et al., 2007, p.559). By removing these few nodes, could potentially disrupt or disintegrate the entire network. The last row in the table pictures the effect of removing the five most highly interconnected nodes.

There are a number of similarities and differences between each type of network. It is very obvious from the table that the networks are classed structured, semi-structured or random based on the entropy value. For instance, a regular network has an entropy value equal to zero and therefore it is heavily structured. On the other end of the spectrum is the random network, which has a high entropy value and as a result it has no obvious network structure (Lewis, 2009, p.58).

The random network has the smallest cluster coefficient (Newman, 2010, p.402), suggesting a little structure. The small-world network has the largest cluster coefficient even though its degree sequence is very similar to that of a random network. The high cluster coefficient is a distinguishing feature of a small-world network (Vitevitch, 2014, p.200; Lewis, 2009, p.62).

A scale-free network is categorised by the many nodes with very low degree and one node with very high degree (Vitevitch, 2014, p.200). Consequently, scale-free networks also display a small graph diameter, similar to a random network. The diameter of scale-free networks is one-half of the small-world network and 50% smaller than the diameter of a random network. The large hub degree is a distinguishing property of scale-free graphs (Alderson, 2008, pp.1051-1053; Lewis, 2009, p.62).

In a nutshell, network measures are employed to characterise networks so that the networks can be analysed, scrutinised and comprehended. Basic measurements are divided into measures for properties of nodes and edges, local measures that describe the neighbourhood of a node or the occurrence of sub-groups and global measures that analyse the interconnectivity structure and statistical properties of the entire network (Vitevitch, 2014, p.199). Next, the visualisation of the results of the network measurements and structures of networks is discussed.

4.4   Network Visualisation

Previously, a number of basic measurements and network types were introduced with the focus on identifying unique characteristics which can be used to perform exploratory analyses on organisational or social networks. However, one important aspect of exploratory analyses is to present or visualise the results in an effective and efficient manner. This section briefly focuses on tools that could visualise network properties and network structures pertaining to small to large size and complex real-life networks; for instance, organised crime networks.

Börner et al. (2007) delineate visualisation as a technique that supports exploration and decision making by communicating the results of network measurements or by visually comparing the structure and dynamics of networks. Pinheiro (2011) concurs with the definition and listed a number of visualisation techniques, which range from well-designed tables (matrixes) that support easy comparison, layout of networks (structure of networks), to visualisation of network dynamics. Each of these techniques is concisely introduced and articulated in the rest of this section.

4.4.1 Matrix Visualisation

Section 4.2.4 highlighted four main matrixes that could be used to construct and analyse networks in order to comprehend network structures and attributes. The four matrixes include Connection, Adjacent, Laplacian and Path matrixes. These matrixes can be visualised by applying dense pixel displays, also known as structure plots. In these plots, the existence of an edge/link between two nodes is indicated by the shading of an area. Dense pixel displays are very useful to display the structure of small, medium and very large networks.

Normally, each pixel displays the relationship between two nodes only. A value of zero has normally no shading of black (i.e. white block), while high values are normally depicted with dark shades (grey to black tones) of black. For small and medium networks, each dense pixel exhibits one relationship between two nodes. In the case of large networks, i.e. networks that have more nodes than there are pixels on a monitor, the nodes can be represented by averaging over a certain number of nodes.

To exemplify the concept of pixelating the different matrixes, let's consider the adjacent matrixes for Figure 4.2(a) and Figure 4.3(a). Tables 4.2 and 4.3 denote the respective adjacent matrixes without pixelating the different cells, whereas tables 4.4 and 4.5 represent the pixelating adjacent matrixes. It is easily noticeable from table 4.4 the symmetrical nature of the edges/links between the nodes, which is a strong characteristic of undirected graphs. As a result, the analyser only needs to consider the lower or upper half of the table to comprehend the connections between nodes. To the contrary, table 4.5 highlights the non-symmetrical nature of the structure. This distinct feature allows for quick identification of directed graphs. Further on, the initial distinction could prompt the analyser to identify the in-degree and out-degree values for each node, so that the current importance of the nodes could be established for future analyses.

	V_1	V_2	V_3
V_1	0	1	0
V_2	1	0	1
V_3	0	1	0

Table 4.2: Adjacent Table for Undirected Graph.

	V_1	V_2	V_3	V_4
V_1	0	1	0	1
V_2	1	0	1	0
V_3	0	1	0	0
V_4	0	0	0	0

Table 4.3: Adjacent Table for Directed Graph.

	V₁	V₂	V₃
V₁	0	1	0
V₂	1	0	1
V₃	0	1	0

Table 4.4: Pixelating Adjacent Table for Undirected Graph.

	V₁	V₂	V₃	V₄
V₁	0	1	0	1
V₂	1	0	1	0
V₃	0	1	0	0
V₄	0	0	0	0

Table 4.5: Pixelating Adjacent Table for Directed Graph.

4.4.2   Tree Layout Visualisation

Another common method to visualise the results of network measures and structures is the application of tree layouts. The main reason for the popularity of this method is the fact that many networks are naturally structured in tree format, such as family trees, phylogenetic trees, organisational charts, classification hierarchies or directory structures (Börner et al., 2007, p.582). As alluded to by Börner et al. (2007), there is an abundance of algorithms available for network analysers to generate three structures, based on the dataset and task differentiation. The most common algorithm, includes among others:

- Dendrograms;
- Radial Tree Layouts;
- Hyperbolic Tree Layout; and
- Tree maps.

Dendrograms are simple, yet extremely effective, methods for the representation of tree data. This tree layout diagram is drawn as an upright or left to right tree. The branching tree-like diagram effectively represents the hierarchical relationships among nodes and the length of the edge/link varies based on the edge/link attribute value. Figure 4.7(a) epitomizes a basic dendrogram (Börner et al., 2007, p.582). In this dendrogram, nodes one (1) and four (4), nodes nine (9) and ten (10) and so forth are clustered together due to the similarity in distances. Further to that, clusters containing nodes one (1) and four (4) and nodes nine (9) and ten (10) are also clustered together due to their combined similarities. In terms of organised crime, each cluster could, for example, indicate similar functions in the organised crime group.
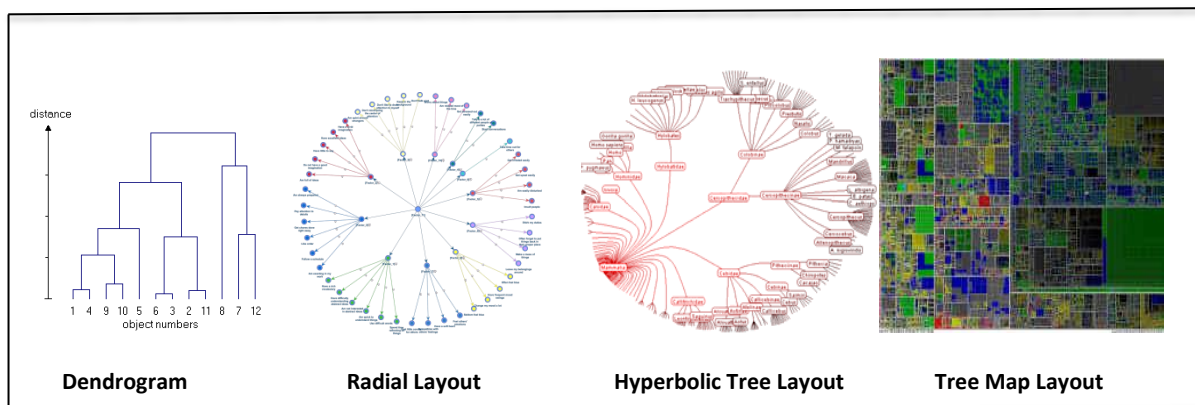
Figure 4.7: (a) Dendrogram, (b) Radial Layout, (c) Hyperbolic Tree Layout and (d) Tree Map Layout [Adopted from: (Börner et al., 2007, p.583)].

Radial tree layout allows for visualisation and manipulation of large hierarchies. For this layout, the focused node is located in the centre of the display and all other nodes are condensed on suitable circular levels around the selected node. Importantly, the further away the node is from the centre, the more it is condensed. This layout permits the network analyser to focus more easily on the important nodes and edges/links in the centre of the graph (Börner et al., 2007, p.582).

Unlike radial tree layouts, *hyperbolic tree layouts* locate the root in the centre and the nodes to the outer of the layout. The children nodes are placed at the outer ring in equal distance to their parent nodes. The boundary of the layout increases simultaneously as the radius increases; resulting in more space becoming available for the growing number of intermediate and leaf nodes. One significant difference between the radial tree and hyperbolic layout is that the hyperbolic tree layout uses a non-linear technique to accommodate focus and context for a large number of nodes, which makes it extremely useful for medium to large networks (Börner et al., 2007, p.583).

The final layout is called *tree maps* which are used for high resolution layouts of network elements. Figure 4.7(d) exemplifies a basic tree map. Tree maps use space filling technique to map a tree structure (e.g. file directory) into nested rectangles with each rectangle representing a node. At first, a large rectangular area is allocated to hold the representation of the tree; thereafter this area is then subdivided into a set of rectangles that represent the top level of the tree. The process of subdividing rectangles into sets of smaller rectangles continues until all child-rectangles are enclosed by their parent rectangle. Area size and colour are normally used to encode two node attribute values, such as gender and age. Tree maps have been used in the past with great success to identify large files in nested directory structures or to make sense of stock option trends. It also has the potential to easily point out important nodes in large networks, which could be extremely useful to identify leaders in an organised crime network (Börner et al., 2007, p.583).

4.4.3 Graph Layout Visualisation

Graphs are the most common method of displaying network measurements and network structures. Figures 4.2 to 4.6 are all examples of graphs denoting network structures, albeit that they represent simple networks. Graph layout analytical guidelines can be utilized to

evaluate and infer both simple and complex graphs. The adherence to good aesthetic principles, that is, non-overlapping, evenly distributed nodes, uniform edge/link length, and so forth, determine ultimately the useability and value of the graphs (Börner et al., 2007, p.584). Therefore, it is highly recommended to position nodes by their attributes; for example, time or size or by their structural features, such as their degrees.

The arrangement of nodes is further impacted by the size of the network. For small networks (networks that have up to 100 nodes) all nodes, edges and their attributes should be displayed on the same graph for analysis. Instances of small networks include, among others, social networks, food webs and import and export networks. According to Börner et al. (2007), the general criteria to map measurement results in graph format for small networks is as follows:

- The node (area) size is commonly used to encode primary values, such as size, importance, power or activity level.
- Node colour is often used to encode secondary values, such as intensity and age.
- Node types are often set by node shapes, e.g. people, knowledge and so forth.

Medium sized networks are classified to have more than 100 nodes, but less than 1001 nodes. For these networks, most if not all nodes are displayed, but only the important attributes or labels are included on the graph. Moreover, not all the edges are shown on the display.

Large networks are referred to as networks with more than 1000 nodes. Examples of such networks include, among other things, the Internet, wireless networks, e-mail interaction networks and so forth. For these networks, neither all nodes nor all edges/links are exhibited at once. It is recommended that the important nodes, edges/links or sub-graphs should be identified first based on the computed network measure values. It is also important to distinguish and display the strong and weak links. The most important nodes and links are then presented as a 'super node', the size of which might represent the number of nodes included by the super node. The visualisation of the nested structure as super nodes is then used to comprehend the global structure of the network. Once comprehended, the analyser could drill-down into smaller sections of the network in more detail.

4.4.4   Visualisation of Network Dynamics

Almost all networks, such as social networks, electricity and transport systems, and the Internet are changing states from one stable condition to another as they are optimised for best performance. This process relates to the emergence of networks as discussed in section 4.2.2 (Lewis, 2009, p.19). Visualisation of this process is normally revealed by visualising network evolution and/or dynamics of the network.

The *visualisation of network evolution* is conducted by employing diverse metaphors, such as time lines, galaxy visualisation of networks or overlay of nodes and edges/links on reference maps (Börner et al., 2007, p.586). The focus of this process is to show the evolution of

networks in terms of attribute or structural changes, that is, increase or decrease in the number of nodes and edges/links or network measures.

The *visualisation of the dynamics* on networks, on the other hand, is concerned with the flow dynamics over a fixed state network. An example of a flow dynamic might be the procurement activity of illicit products by end users in an organised crime environment. In order to comprehend the flow dynamics, a reference system (Baseline) is used, whereby the network structure for a given state of the network and visual representation of activities are depicted together. Activities are often represented by line overlays. Arrow heads are predominately used to indicate directedness in the activity diagram or alternatively, line thickness, shading, colour and other forms of coding can also be exerted to indicate edge/link directions. Moreover, the visualisation of network dynamics can be static or animated over time (see chapter 8 for an example).

Network visualisation enables researchers or network analysers to effectively assess, explore and comprehend complex networks. A number of tools/techniques can be applied to communicate the results of the network measurements and to visually compare the structures and dynamics of networks. Four main visualisation tools/techniques have been highlighted in this section. The tools/techniques include, inter alia: matrixes; tree layouts; graph layouts and visualisation of dynamics on networks. It was concluded that matrixes are very useful to quickly identify the nature of the inter-linkage patterns, whereas tree layouts exhibit the hierarchical relationships among nodes in small, medium and large networks. Further on, graphs are predominately used to study the structure of networks, especially for larger networks to identify common patterns, such as cliques and clusters. The final technique visualises the dynamics of networks and is employed to understand the activities or processes followed by nodes in the network. Having articulated the network properties, network measurements and visualisation tools/techniques to investigate and depict results effectively, the next step in accessing and inferring organisational networks is to define the evaluation criteria. A summary of the evaluation criteria is provided in the next section.

4.5   Evaluation Criteria

In the foregoing section, an introduction summary of network visualisation has been provided with the emphasis on communicating the results of network measurements clearly and professionally, as well as to provide a tool to precisely compare the structure of the dynamics of empirical and simulated networks. In order to explore the results of network measurements and the graphical representation of the structure of the networks, it is important to follow a methodical and meticulous approach to comprehend the results.

Rinheiro and Reis (2011) explain a five steps exploratory approach for analysing social networks, based on the general network measures defined in the network science discipline. The five steps include:

- Basic node and link behaviour analyses;
- Compute node/edge, local and global network measures;
- Network measures analyses;
- Community comparisons; and
- Repeat steps one to four after each emergence of network.

The *first step* in the process is a relative basic activity which relates to the observation of the dataset; notwithstanding the basicness, it is one of the most important studies that network analysers can perform as it will assist them in getting a good initial understanding of the network anatomy. The main focus of this step is firstly to identify all relevant nodes and edges/links pertaining to the network of concern, and secondly to determine the *most important nodes and edges/links* in the network by means of highlighting the individual attributes for each link, such as frequency, relevance, regency and so forth. Those distinct attributes are subsequently being used to create different weights for all nodes and links in the network (Börner et al., 2007, p.543). Nodes comprising high valued links become more important than nodes without high valued links; furthermore, links connecting two high valued nodes together are weighted even higher than links connecting only one important node. Hence, the outcome of this step is the identification of important nodes and links, as well as initial identification of possible hubs, cliques and the importance of each node and link within the network (Rinheiro and Reis, 2011, p.17). The conclusions of this step can be visualised in algebraic matrix tables.

Next, the *node/edge, local and global network measures* as described in the preceding sections must be calculated to represent the properties or characteristics of the network, as well as the sub-networks within it. The measures include, among others, number of nodes, number of edges/links, degree of each node, eigenvector centrality, closeness centrality, betweenness centrality, clustering coefficient for important nodes, clustering coefficient for entire network, identification of cliques, cutting points or boundary spanners, hubs and authorities, graph entropy, average centralities and average degree of network and average path length. The result of this step highlights the size of the network, the centrality of each node in relation to other nodes in the network, the closeness between them, influence and power of each node and so forth (Rinheiro & Reis, 2011, p.17). The results of the network measurements can be visualised by way of matrixes, tree layouts or graph layouts.

During the following step, the above *network measures are compared and contrasted* to enhance and comprehend the pattern of behaviour for the entire network, including the individual behaviour for each node and edge/link inside the network. The aim of the comparison and contrasting process is to identify possible cliques, boundary spanners, hubs, authorities, adopters, diffusors, influential individuals and opinion leaders (Rinheiro & Reis, 2011, p.17). Adopters are individual nodes that accept ideas, information, goods and so forth from other nodes, resulting in a noticeable change in action or behaviour by other connected nodes. Diffusors, on the other hand, are individual nodes that push ideas, information, goods and so on through the network via the links/edges for maximum distribution. Importantly, the actions of diffusors may or may not bring change to the behaviour of other nodes and the network in its entirety (Rinheiro & Reis, 2011, pp.15-20).

Influential individuals are those nodes that feed innovations, rumours, beliefs, opinions and information to the leaders and then back down to the rest of the population (Rogers, 2003). Likewise, opinion leaders are key nodes situated on key communication pathways in the network that have the ability to control resources and information within the network, typically by exercising some type of structural advantage over other nodes.

In the course of the fourth step, the entire *population is segregated into smaller connected communities*. Similar to the comparison analysis for nodes and links/edges in step two, a comparison evaluation between the different smaller internal communities has the potential to highlight how the network is clustered together, as well as which communities are more important in terms of their network properties. In this context, the average community matrixes are compared with average community matrixes of other communities, individual nodes and links/edges within the community, as well as the average matrixes of the entire network (Rinheiro & Reis, 2011, p.17). Graph layout visualisation techniques are extremely useful in segregating the population as hubs and authorities are in most cases highly visual.

The focus of the final step is to comprehend the network synchronisation evolution of the network by *repeating foregoing steps one to four* a number of times in the case of dynamic networks. In practical terms, every time when new information becomes available for evaluation and the network is changing fixed point states, the network analyser should repeat steps one to four. Time line and node action graphs are very useful tools to understanding and investigating the evolution of the network.

A number of common factors exist that could affect the relationships of nodes within the network, which should be included in the investigation of preceding steps two, three and four. These factors include, among others, prestige, homophily, proximity, reciprocity and transitivity (Newman, 2010, pp.198-225). *Prestige* in a network science context epitomizes social norms that refer to the status of a node/person and in more particular how important a person is within the network (i.e. follower verses frontrunner). Social norms in terms of prestige refer to the position of the node/person in the society, such as star athletes, lawyers, doctors, engineers, and so forth. Nodes/persons with high prestige are mostly administrators with decision-making powers, control of resources and so forth.

Homophily relates to nodes/persons with the same attributes, such as age, hobbies, culture background and etc. (Newman, 2010, p.220). It is especially apparent in delinquent peer networks, such as street gangs. The significance of homophily can be summarised in that nodes/persons with similar specific attributes will most properly stick together, resulting in more information being exchanged among them and more coverage of available opportunities to prosper within the network. Furthermore, the increase in association could ultimately lead to more conformity and closer ties. Homophily is typically operationalized by male/female groupings and occupational segregations.

Proximity of nodes/persons pertains to the closeness in space in terms of physical or organisational structure. Nodes/persons who are located in the same office, and who are on different levels in the organisational structure, could cultivate more opportunities for

interaction and discovery. This enhanced opportunity is referred to as social capital – the value of who you know.

Reciprocity in network science terms alludes to the reciprocating of friendship initiated by others (Newman, 2010, p.204). Positive reciprocation can lead to stronger links or connections between two nodes/persons, whilst negative reciprocation can lead to the deteriorating or vaporing of links as the network emergence over time. Last mentioned can lead to negative relationships that subsequently could lead to revenge.

Transitivity is premised on the argument that links between nodes/persons are created through common friendships (Newman, 2010, p.198). For instance, if node A knows node B and node A knows node C, then there is a strong possibility that node B will know node C as the network will emerge over time.

Table 4.6 outlines the five steps exploratory approach by describing the basic method of procedure for each step, as well as the expected outcome for each step. It is envisaged that these steps could be followed by law enforcement officers or criminal investigators in a semi-automatic or fully-automatic manner to get a better understanding of each case. Possible final outcomes could be the formation of destabilising strategies, improvement of current organised crime control policies, development of prosecution material, such as organisational charts, and/or prediction of sentences for each member based on his/her involvement in the network.

Step No.	Description	Plausible Outcome
One	Basic Node and Link Behaviour: 1. Conduct content analysis on source data. 2. Identify all possible nodes. 3. Identify all pertaining relationships. 4. Weighted each node and link. 5. Populate matrixes.	Applicable matrixes that represent the organisation under investigation. High-level layout or network structure of the organisation under investigation.
Two	Compute node/edge, local and global network measures: 1. The Degree of a Node. 2. Power Index. 3. Eigenvector Centrality. 4. Closeness Centrality. 5. Betweenness Centrality. 6. Graph Entropy. 7. Average Overall Degree Centrality. 8. Average Overall Closeness Centrality. 9. Average Overall Betweenness Centrality. 10. Average Overall Eigenvector Centrality. 11. Node Degree Distribution. 12. Boundary Spanner Measurement. 13. Hub Measurement.	The measures determine size of network, overall betweenness of nodes in ranked order, overall closeness of nodes in ranked order, overall influence of each node in ranked order and overall power of each node. Nodes with high degree of betweenness indicate members with control and low-level dependency on mediators. Network with high degree of closeness indicate good efficiency and overall effectiveness in the network. A list of nodes and links not active in data set is also provided, including an

	14. Authority Measurement. 15. Graph Entropy. 16. Degree Correlation Function. 17. Node Betweenness Distribution. 18. Average Cluster Coefficient. 19. Average Path Length.	explanation of the significance thereof. Criteria: 1) If degree of a node has a high numerical value it represents a node with a high-level of opportunity to influence others in the network. High in-degree denotes possible leader (members reporting to those nodes), while high out-degree highlights possible soldier. 2) If power index has a high numerical value for a node, it signifies a powerful node. 3) If Eignenvector Centrality for a node has a high numerical value it highlights that the node is very important, relevant and powerful in the network. 4) If closeness centrality for a node has a high numerical value then it represents a node with high indirect influences, thus high intermediary power. 5) If betweenness centrality for a node has a high numerical value then it indicates that the node has a high directed influence in the network. 6) If cluster coefficient of a node has a high numerical value (close to 1) it indicates that the node has a high cohesiveness among other nodes. 7) If the average cluster coefficient of the network has a high numerical value (close to 1) it represents high cohesiveness among nodes, as well as regular lattice graph shape layout. Conversely, low value denotes random graph shape layout. 8) If boundary spanner measurement has a high numerical value for a node, it indicates possible bridging functionality of the node. 9) If hub measurement for a node has a high numerical value it signifies that the node has a high-level of control in the network. Therefore, this node determines the effectiveness of the network. 10) If authority measurement for a node has a high numerical value then it denotes that the node has a high-level of control in the network. Therefore, this node controls the effectiveness of the network.

		11) A high entropy value indicates more randomness and less structure in the graph, resulting in greater variability and more uncertainty in terms of the structure, while low entropy value (closer to 0) denotes less randomness and more structural graph.
		12) The degree sequence distribution highlights the 'shape' of a graph, whilst entropy points out the regularity or lack of it in the shape. Therefore, the more regular the shape of a graph, the less randomness and the less entropy there is in a graph. At one extreme, regular graphs have very little entropy and at the other extreme, random graphs have very little regularity.
Three	Network measures for the comparison and contrasting process: *Statistical measurements:* 1. Mean of overall In-degree. 2. Mean of overall Out-degree. 3. Mean of overall Closeness Centrality. 4. Mean of overall Betweenness Centrality. 5. Standard Deviation of overall In-degree. 6. Standard Deviation of overall Out-degree. 7. Standard Deviation of overall Closeness Centrality. 8. Standard Deviation of overall Betweenness Centrality. 9. Sum Total of overall In-degree. 10. Sum Total of overall Out-degree. 11. Sum Total of overall Closeness Centrality. 12. Sum Total of overall Betweenness Centrality. 13. Minimum In-degree. 14. Minimum Out-degree. 15. Minimum Closeness Centrality. 16. Minimum Betweenness Centrality. 17. Maximum In-degree. 18. Maximum Out-degree. 19. Maximum Closeness Centrality. 20. Maximum Betweenness Centrality. *General measures:* 21. Average Path Distance among all nodes in Network. 22. Heterogeneity of Members in Network.	Identification of possible cliques, boundary spanners, hubs, authorities, adopters, diffusors, influential individuals and opinion leaders. Criteria: 1) The mean In-degree and Out-degree values highlight whether or not the network is symmetric, or not. A high standard deviation for In-degree and Out-degree signifies large difference between the numbers of relationships that each node has (e.g. core nodes have significantly more relationships compared to peripheral nodes). A few nodes with high Out-degree and In-degree network measures indicate significant centralisation around these important nodes; thus, a centralised network structure. 2) Average degree centrality - The lower the connections between nodes in comparison with the total number of connections, the more fragmented the network. Low connections are normal for illegal networks. 3) Mean overall betweenness centrality – The higher the value of the measurement, the greater the level of control and the less the effectiveness of the network. 4) Mean overall closeness centrality –

	23. Network Centralisation (In and Out-degree). 24. No. of Core Nodes. 25. No. of Peripheral Nodes. 26. Density of Entire Network. 27. Density of Core Network. 28. Density of Peripheral Network. 29. Total No. of Relationships in Network. 30. No. of Relationships in Core Network. 31. No. of Relationships in Peripheral Network. 32. Average Path Distance between Core Nodes. 33. Average Path Distance between Peripheral Nodes. 34. No. of Cliques. 35. No. of Boundary Spanners. 36. No. of Hubs. 37. No. of Authorities. 38. No. of Adopters. 39. No. of Diffusors. 40. No. of Influential Individuals. 41. No. of Opinion Leaders.	The higher the value, the closer are the nodes to one another and the more effective the network. A high value could indicate that the network is susceptive to influences from the outside. 5) Path distance (length) determines the safety and secrecy of illegal networks. Short path distance leads to easy detection of other nodes. 6) Prestige – The higher the status of the node in the society and the more control the member has in the network (that is, high node closeness centrality compared against overall closeness centrality), the more important is the member and the higher the prestige of that member. 7) Identification of possible future relationships by applying the transitivity concept. 8) Identification of influence of each node based on betweenness, closeness and proximity concepts – Thus, high betweenness, closeness and relationship with Core members will depict highly influential members.
Four	Population segregation into smaller connected communities: 1. Remove the Hubs and/or Authorities from the network. 2. The statistical community matrixes are compared with statistical community matrixes of other communities, individual nodes and links/edges within the community, as well as the statistical matrixes of the entire network.	Creation of a low-level layout or network structure of the organisation under investigation. 1) The identification of communities that coexist in the network. 2) The highlighting of similarities and differences within each community and amongst the different communities, in terms of alleged crime, skill level, control, and so forth. 3) The identification of positive and negative relationships based on reciprocity within community that allow for sharing of information, and acting in solidarity and collectiveness. The understanding of reciprocity within communities could lead to the development of effective destabilising activities.
Five	Comprehend the synchronisation evolution of the network by repeating foregoing steps one to four a number of times in the case of dynamic networks.	1) Identification of the core nodes and relationships as the network developed over time. 2) Recognition of the emergent leader over time – Individuals who are

		strong emergent leaders are likely to be well connected to many other nodes, as well as being engaged in complex tasks where they may not have all the required resources or knowledge. 3) Identification of the type of crime or delinquency offended over a period of time. 4) Exhibition of the movement of nodes over time in relation to other important nodes. 5) Recognition of workload – Individuals or organisations that are high in workload are those that are doing more complex tasks and have the resources and knowledge or expertise to do those tasks. 6) Proposal of possible punishment based on involvement in smaller communities and control in network. 7) Definition of destabilising actions/strategies. 8) Compilation of the evolvement of the network over time in terms of organisation charts and network layouts.

Table 4.6: Summary of the Outcome of the Approach.

Table A1 in appendix A practically applies table 4.6 and represents an instantiation of the five steps approach in terms of the organised crime phenomenon in table format. Each of the five steps is mapped out in relation to the holistic taxonomy and applicable independent variables as formulated in the previous two chapters. The possible outcome in terms of organised crime is also briefly discussed. The table serves as the blueprint for the investigation of other real organised crime case studies in chapter 6.

Rinheiro and Reis (2011) assert that all data in relation to social networks are critical when conducting an in-depth exploratory analysis. This section focused on an approach that collates and explores the results of the various network measures in five sequential steps. The corollary of this process, as outlined in table 4.6, is a detailed explanation of the results, importance of certain nodes, network behaviour, clusters within the network, weak points of the network, and potential outcomes, such as remuneration or punishment for actions. Having defined the exploratory approach, it is now possible to evaluate the feasibility of the approach by means of a real practical case of terrorism and organised crime.

4.6   Applying Network Science to Organised Crime

A simple exploratory approach for analysing the dynamics of networks was introduced in the foregoing section. This section will now discuss how the approach can be applied to organised crime in an innovative and novel way, by examining a case study based on a substantive terrorist/organised crime case. The case study was briefly introduced in section 3.7 to highlight the initial usefulness of the independent variables. The same case study is now further elaborated on in more detail to explicate and evaluate the exploratory approach. The discussion commences with a short background of the alleged criminal group, followed by an articulation on the data and methods used by the researchers to investigate the case, as well as a brief discussion on the analyses process and results. It concludes with a short review of the findings of the study.

4.6.1   Background of Case Study

The researchers from the University of Central Florida embarked on an empirical study of dark networks, which refer to covert and illegal networks, by focusing on the structural aspects of criminal networks (Demiroz & Kapucu, 2012, p.271). The objective of the study was to construct a representation of the ETO network in an easy and understandable graph format, to identify the core nodes (suspects) in the network and to propose appropriate sentences for each suspect based on the applicable role and indictment.

The investigation employed network science as the premise to examine the structural aspects shaped by the organisational goals, covertness and safety dimensions. The researchers asserted that covertness of an organisation is strongly related to its structure (Demiroz & Kapucu, 2012, p.273). Furthermore, they claim that the organisational structure is shaped by organisational goals and the need for covertness and safety. Therefore, by analysing the nodes and relationships could reveal significant information about the goals and modus operandi of an organisation.

The examination of dark networks is predominantly conducted by analysing Turkey's Ergenekon Terrorist Organisation (ETO), which is a political conspiracy network that has played a significant role in the terrorist activities within Turkey. The group has features of organised crime enterprises, terrorist organisations and clandestine armies. This analysis investigates the structure of the ETO by employing a well-known network analysis tool and court documents as the data source. Therefore, this case study is highly applicable to this research project.

4.6.2   Data and Method used for Case Study

The researchers consider secondary and tertiary sources, such as court transcripts, congressional hearings, newspaper articles and insider books for gathering data about the organisation, as suggested by Milward and Raab (2006). At the end, they exerted publicised court indictments prepared for the ETO case to examine the structure of the organisation. Three indictments were prepared over time as the scope of the trial has grown and the number of detainees increased. The three indictments related to 194 suspects; the results

reported on in this case study are based on the first indictment which incorporates 86 suspects.

Two researchers conducted a content analysis of the indictment and recorded all the transactions between the suspects into a spreadsheet codebook. The codebook included, among others, nodes (actors), number of edges/links, and so forth. The relationships were recorded to reflect a directional diagram, resulting in making the network asymmetrical. The researchers utilized a network analysing software tool called UCINET software and recorded the relationships on an adjacency matrix.

One of the objectives of the study was to identify appropriate punishments for the suspects. A number of punishments were suggested based on the calculated network measures. These measures have also taken into consideration the Turkish penal code and feedback received from a law professor.

4.6.3 Analyses and Results

A summary of the results of the UNCINET analysis are depicted in Tables 4.7 and 4.8. The results are next presented and discussed according to the methodology of the five steps exploratory approach.

- Basic node and link behaviour analysis:

  The researchers have acknowledged that they have studied the basic nodes and link behaviour for the network, as part of the content analysis of the indictment and recording of all transaction between suspects. Based on the corollary of the analysis, the researchers created the appropriated matrixes.

- Compute node/edge, local and global network measures:

  Node/edge, local and global network measures were computed by the UNCINET software, and descriptive statistics for centrality, and network density for all nodes were published in two discrete tables (Tables 4.7 and 4.8). The descriptive statistics revealed five important characteristics of the ETO organisation, namely network density, degree centrality statistics, network centralisation, betweenness centrality and average distance.

  The network density for the ETO organisation was computed as 0.0982 or if it is normalised, it equals 9.82%. That means that only 9.82% of all possible relationships (718 out of 7310 bi-directional links) within the network of 86 nodes were realised. Furthermore, the degree centrality statistic states that each node has an average of 8.349 in-degree and out-degree links respectively. However, the high standard of deviation of 7.687 for both in-degree and out-degree links, is significant as it points out a large difference between the number of ties that each node has (managers verses soldiers). The minimum in-degree and out-degree statistic highlights the fact that one node is completely isolated, whilst the maximum in-degree and out-degree statistic

exhibits that one node has 33 in-degree and 35 out-degree relationships. Consequently, this node is very important and powerful in the context of the ETO network.

Moreover, the in-degree and out-degree network centralisation measures are 29.343% and 31.723% respectively, which point to significant centralisation around a few of the nodes. Thus, this measure highlights the centralised structure of the network. Also, the betweenness centrality statistic shows an average score of 116.047 per node with a standard deviation of 246.767. Once again, the high standard of deviation points out the difference between the manager and soldiers in terms of the control of communication and resources within the network.

The path length between nodes reflects the level of safety and secrecy of the illegal network. In the overall network, the average path length identified between two random actors equals 2.456, which means that a node in the network is approximately two and half connections away from any other random node. This is a reasonably short path distance, engendering a low safety and secrecy characteristic and can lead to detection of other nodes fairly easily. As depicted in table 4.8, the average path length varies substantially between the core and peripheries of the network. The reason for this importance is that if the core nodes are isolated from the network, the overall path distance will increase to 3.939 among the peripheral nodes, as well as the isolation of six nodes from the network.

The topology of the network is represented in the shape of a WEB-based diagram (which resembles a radial layout diagram). A number of these diagrams were constructed to depict networks of nodes (actors), degree centrality and betweenness centrality values. In each diagram, the size of the nodes indicates each node's degree and betweenness centrality levels respectively. When examining the overall network, it is evident that the network comprises 12 core nodes (1, 4, 8, 9, 15, 22, 28, 29, 42, 45, 56 and 65) and 74 peripheral nodes based on the degree and betweenness centrality levels. Further on, as illustrated in table 4.8, less than ten per cent of all possible connections between network nodes have been actualised. Also, the density of relationships changes extensively while the network is examined discreetly as core and periphery. The density of the core network is 73.48%, whilst this figure drops down to 4.41% in the periphery network.

Ref No	Description	Betweenness	Out-Degree	In-Degree	Total
1	Mean	116.047	8.349	8.349	
2	Std Dev	246.767	7.687	7.687	
3	Sum Total	9980	804	804	
4	Minimum	0	0	0	
5	Maximum	1407.252	35	33	
6	Number of Nodes	86	86	86	
7	Network Centralisation		31.723%	29.343%	
8	Heterogeneity				2.06%
9	Network Density				0.0982

10	Network Centralisation Index				18.30%
11	Un-normalised centralisation				111043.668
12	Average distance among reachable pairs				2.465
13	Distance-based Cohesion (Compactness)				0.435

Table 4.7: Summary of Descriptive Statistics for Centrality Measures (Demiroz & Kapucu, p.282).

Ref No.	Description	Density	No of Ties	Avr. Path Distance	Avr. No. of Connection
1	Entire Matrix (86 nodes)	0.0982	718.000	2.465	116.047
2	Core 12 actors	0.7348	97.000	1.265	8.5
3	Peripheral 74 actors	0.0441	238.000	3.939	3.757

Table 4.8: Summary of Network Density for all Actors, Core Actors and Peripheral (Demiroz & Kapucu, p.284).

- Community comparison:

  By extracting the 12 core nodes from the network exposes the fragmentation of the network. The researchers also used a WEB-based diagram to illustrate the network of the 74 peripheral nodes, where node sizes represent the possible years of punishment. The diagram is vividly exhibiting the fact that the network consists of two large clusters (or also known as smaller communities). Each cluster comprises nodes with similar backgrounds. The one cluster consists of 'low key' soldiers, while the other reflects more important soldiers in terms of their actions and resources. Hence, the proposal is to charge the so called 'important' soldiers with more severe crimes and subsequently infer that they should receive more server punishment.

- Repeat steps one to four after each emergence of network:

  The case study only examined one network state of the ETO organisation. However, the researchers have pointed out that future case studies might follow that scrutinise other states of the network.

4.6.4 Findings

The following facts were derived from the analysis:

- The study found that the network has a concentrated centralised structure which consists of a core and periphery group of actors (nodes).

- The core group has a strong connectedness among each other.
- The density of relationships is not homogenous in the ETO network; core members have dense relationships, while the peripheral subgroups have a relative low density.
- Peripheral actors are separated into sub-groups which are necessary for operational purposes.
- The average path lengths of nodes within the network were not distributed normally in the core and periphery. The core members were able to reach each other almost through one connection, while peripheral nodes needed four connections to reach other random peripheral nodes.
- Based on the network structure, twelve members were identified as the main culprits. Consequently, potentially higher punishments were proposed for them. (The assumption that individuals with a higher position in the organisation should have a higher chance of getting a more severe punishment was applied to proposed punishment).
- The low heterogeneity measure could be explained by the resemblance in method of operation, e.g. using of weapons, communications, etc.
- The study has highlighted that the ETO has built up its structure through elitism and political immunity approach, which is a contradiction to what literature suggests.
- A high level of homophily was noticed in each of the peripheral groups. This characteristic was further used as the premise to judge punishment for each group member (Demiroz & Kapucu, 2012, pp.285-290).

Above case study illustrates one instance of how network science, and in particular the five steps exploratory approach, can be employed to comprehend and infer complex terrorist/organised crime cases. The study highlighted the value of certain network science measures, such as centrality calculations, resulting in the identification of the twelve core members in the network. A strategy to destabilise the network has also been proposed by eliminating three bridging nodes. Furthermore, punishments for the twelve members and others have been proposed based on their involvement in the network and their applicable indictment. The five steps exploratory approach is further explored in chapters 6 and 8 as more organised crime cases are analysed and extrapolated in order to get a better understanding of the phenomenon.

4.7   Conclusion

Rinheiro and Reis (2011) assert that network science is a contemporary burgeoning field employed to unearth knowledge in many disciplines, such as telecommunication, social media, product and service acquisition, insurance, banking and so on. One of the core concepts of network science is that most phenomena can be represented in a network format and the exploration of knowledge on how people or objects (known as nodes) behave inside the network can be comprehended by analysing the adjacent people, objects, relationships and so forth. This chapter introduced network sciences as a vehicle to analyse the role of each node inside the network, how they connect to one

another, how strongly they connect to the other nodes, how central they are in the network, how many short paths they belong to, and so on. The articulation of network science was conducted by introducing common and important notions and notations, network measurements, network visualisation and evaluation criteria.

General and important notions and notations related to network science were introduced by mainly focusing on graph theory; the emphasis was on exploring the most important definition of network science, general principles related to the science, algebraic definitions and notations of graphs, and matrix algebra definitions of graphs. It became evident while studying these formulas and geometric concepts of graphs that network science has the potential to be encompassed into an approach or algorithm that could comprehend structural characteristics and be applied to most substantive real-world problems that involve huge social networks.

A number of network measures were introduced in the middle part of this chapter which can be employed to characterise networks, so that the networks can be analysed, scrutinised and comprehended. Basic measurements have been segregated into measures for properties of nodes and edges, local measures that describe the neighbourhood of a node or the occurrence of sub-groups, and global measures that analyse the interconnectivity structure and statistical properties of the entire network.

Various tools/techniques were also presented in the latter part of this chapter to communicate the results of the network measurement and to visually compare the structures and dynamics of networks. Four main visualisation tools/techniques have been highlighted and some of the tools/techniques include, among others: matrixes; tree layouts; graph layouts; and visualisation of dynamics on networks.

The final part of this chapter focused on an exploratory approach that collates and explores the results of the various network measures in five sequential steps. The corollary of this process is a high-level description of the procedure to follow in order to apply network science to social network related disciplines, such as organised crime investigations. Other noticeable outcomes relate to the meticulous presentation of the results, highlighting the importance of certain nodes, network behaviour, clusters within the network, weak points of the network, and potential punishment for actions taken within the network. Finally, the approach was evaluated by applying it to a substantive organised crime case. The initial results of the evaluation suggest that the approach has the potential to be applied to organised crime cases in a more general manner.

Since organised crime, possible variables to measure actions of organised crime members and an approach to evaluate the characteristics and dynamics of organised crime organisations are introduced and articulated, it is now possible to apply this knowledge through proper research methods. The next chapter is providing a roadmap in terms of which research methods and techniques are to be followed in order to translate this notional knowledge into substantive real-world outcomes.

Chapter 5

Research Methods

Research Methods

This chapter focuses on:

- Delineating a formal problem definition for this thesis;
- Articulating the challenges associated with the organised crime phenomenon;
- Describing the research issues which need to be addressed; and
- Articulating the research methodology and methods that are applied in this research project to meticulously address the research issues.

5.1   Introduction

Chapter 1 presented a brief overview of the organised crime phenomenon in order to establish the prominence of this thesis with the main focus on introducing the phenomenon, highlighting the significance of the phenomenon in terms of financial cost and other social impacts, delineating the motivation and objectives for the research project, as well as emphasizing the intended outcomes of the project. Chapter 2 continued to explore the crime phenomenon by presenting literature on the most prominent concepts of organised crime, current investigative approaches, and national and international counter measurement strategies. The corollary of this chapter was a generic holistic taxonomy that encompasses the most important aspects of organised crime.

Next, chapter 3 introduced criminological theories associated with crime and criminality in general. The aim of the study was to get a better understanding of organised crime in terms of the various explanatory theories and to apply the holistic taxonomy in order to identify suitable attributes or variables. It was established that the attributes and variables could depict the organised criminal group in a more understandable manner, as well as providing valuable input information to a systematic approach that can then comprehend the behaviour and activities conducted within the group in a timely fashion.

The final part of the literature review, chapter 4, concentrated on one such approach that adopted network science as its platform to map the variables, compute the various mathematical and statistical measures, and visualising the results. It was pointed out that network science provides a solid mathematical background to infer visual observations and calculations, making the approach highly suitable for most research designs.

However, each of the four literature reviewed chapters listed a number of issues relating to organised crime that requires addressing within the research design for this project. Based on the foregoing issues, this chapter now focuses on outlining the main problems to be addressed and

identifies the formal description of research issues, which serves as the basis for the development of subsequent chapters. It also provides an explanation of which research methodologies and methods are to be used further in the research project.

The chapter commences with the establishment of an official problem statement pertaining to organised crime, which is an extension of all challenges and problems listed in the literature review. This is followed by the articulation of two research issues that are extrapolated from the problem statement. Finally, the chapter concludes with an explanation of the most suitable research methodologies and methods applicable to the research design for this project.

5.2   Problem Definition

The problem under investigation is succinctly defined in chapter 1, based on the challenges and deficiencies identified from a comprehensive review on studies conducted in the fast-developing field of organised crime. Therefore, the problem definition for this project, which is associated with the investigation and control of the organised crime phenomenon, can be encapsulated under the following _five important sub-problems_:

- The phenomenon has become _extremely diverse, lethal and sophisticated_, resulting in billions of dollars of losses to governments, private organisations, and ordinary members of the society world-wide.
- The _lack of a cumulative body of knowledge_ regarding the modus operandi and logistics of offenders, the nature of offender structures and inter-group behaviour and relationships in an organised crime environment;
- The _constricted focus_ of the existing research studies related to the phenomenon;
- The _non-holistic approach_ from governments and law enforcement agencies to investigate organised crime cases; and
- The _non-existence_ of a universal overarching framework and/or model (Morrison, 2002; Wright, 2011; von Lampe, 2012; Spinuzzi, 2016).

Another significant aspect applicable to the problem definition is the current practices related to the investigation of organised crime criminalities. In brief, most organised crime investigators, whether they are professional researchers or operational officers, attempt to address above deficiencies in three major ways, namely:

- Researchers, such as Cressey (1969), Myers (1996) and Demiroz & Kapucu (2012) examine organised crime by concentrating on characteristics of organised crime groups, which predominantly include both structures and familial relationships;
- Other researchers, such as Levi & Maquire (2004) and Bell & Congram (2014) focus on the dynamics of the markets and accessories which enable organised crime organisations to thrive in criminalities; and

- Law enforcement and intelligence agencies, on the other hand, engage in operationalizing strategies and policies, resulting in adoption of case investigation methodology, which mainly focuses on the activities or enterprises of organised criminals (Tusikov, 2011, p.99).

This constricted focus of investigators could lead to incorrect conclusions, as well as prohibiting the development of new innovative frameworks and practical models. Therefore, it is highly recommended that any research project on this notorious difficult phenomenon should, as a minimum, encompass measures of structures and relationships, markets and tools, as well as activities or enterprises of organised criminals. Next, two research issues applicable to the five listed problems are extrapolated and articulated in more detail.

5.3   Research Issue

Against the background of the problem statement in the previous section, two protruding research issues are formulated and highlighted in this section. The research issues are in line with research challenges faced by other international researchers and this research project endeavours to address each of them in the remaining chapters.

In section 2.6, it was highlighted that various research projects are, or have been, in operation to firstly get a better understanding of the organised crime phenomenon, secondly to comprehend the shortcomings of existing counter measures and thirdly to propose new innovative frameworks/methods to destabilise and/or destroy criminal groups.

Although many institutions and researchers around the world acknowledged the need for further research on organised crime, the direction of the effort is still undecided. The overarching consensus of these institutions and researchers is that organised crime has become so complex and diversified that it is extremely onerous to research the phenomenon in a complete package. Therefore, most of these research programs focus either on one end of the spectrum, namely research related to strategies or technical measures that holistically counteract organised crime, or the other end of the spectrum where they concentrate on single crime activity related to organised crime. In some cases, they might also focus on trends and traits of organised crime.

The trade-off between the two main stream approaches is that if researchers focus on holistically counteracting the phenomenon, the computing, visualisation and inference of results become extremely difficult. This is mainly due to the lack of good quality data/information relating to chases in general and existing strategies. On the other hand, by concentrating on a single crime activity might lead to incorrect or inconclusive results in relation to organised crime in general, due to the diversity of the phenomenon.

Hence, a plausible research aim is to find a middle way, one which could compute, visualise and infer organised crime cases accurately on a holistic basis and by the same token overcome the shortage of good reliable data and information by identifying generic variables that could be populated from most public available data sources. As a consequence, the research project selects and describes

two research issues that attempt to address the above problem statement, as well as forming the nucleus of the rest of this project.

5.3.1 Research Issue I: Insufficient data, information and knowledge to investigate, control and counter-act organised crime.

Von Lampe (2012) asserts that all means of data collection normally exerted in social sciences are also being utilized in organised crime investigations. However, the three most essential data and information collections techniques used to collect data, include, observations, interviews and the retrieval of information stored electronically or on paper (Arsovska, 2008, p.48). Notwithstanding the plethora of techniques, many research studies tend to lack detail regarding the modus operandi and logistics of criminal activities, as well as the nature of offender structures.

The main reasons for the lack of detail are ascribed to the difficulty in securing interviews with organised crime criminals, the danger of observing criminals while offending and the restricted access to official documents, such as criminal files, intelligence data and internal case statistics (Arsovska, 2008, p.42). As an alternative, von Lampe (2012) suggests that researchers should at least retrieve data and information from open sources in order to gather better intelligence on the activities and structures of organised crime organisations. The author also proposed that researchers obtain a deeper theoretical insight into aspects, such as the logistics of criminal activities or patterns of criminal cooperation, by extending their research horizon through the comparison of data and information acquired from diverse organised crime criminal activities.

Moreover, the research problem related to the insufficient data, and information issue could be answered by addressing the following research questions, namely:

- "What are the critical attributes (independent variables) necessary for investigating nodes and relationships of organised criminal groups and activities?" (Research question 1);
- "Which theory or approach to behaviourism best explains and predicts individual and groups behaviour of those involved in organised crime?" (Research question 2); and
- "Do criminals follow a general and typical methodology while conducting organised crime and can it be used to investigate future criminal cases?" (Research question 3).

Each of these questions is articulated and addressed in chapter 6 in more detail.

5.3.2 Research Issue II: The absence of a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently

Spinuzzi (2016) and Morison (2002) proclaim that International and Australian researchers, and operational organisations require a framework to study the arduous organised crime phenomenon. Von Lampe (2012) agrees with the authors and claims further that common

intelligible theoretical frameworks for researchers world-wide are required to build a cumulative body of knowledge mainly due to the dynamic field of organised crime.

Morison (2002), Allach (2011) and von Lampe (2012) listed a number of challenges in delineating suitable and effective conceptual and theoretical frameworks pertaining to organised crime. They strongly suggest that these challenges should be taken into consideration while defining new frameworks. The main challenges are as follows:

- In order to discover theoretical insights and/or making correct conclusion regarding this phenomenon, researchers and investigators world-wide need to access and extrapolate similar quality data sources. Von Lampe (2012), Arsovska (2008) and van Duyne et al. (2006) highlight that it is a real challenge for international researchers to obtain high quality data as the level of assistance from authorities varies from country to country. For this reason, von Lampe (2012) recommends including a variety of public data sources as input source for an overarching framework.
- Von Lampe (2012) and Arsovska (2008) further highlight the impact of the scant research knowledge on criminal activities related to organised crime, possibly caused by non-availability or contradictory evidence. Von Lampe (2012) further points out the importance and benefits of including criminal activities in any framework and suggested that pattern comparison and contrasting should be facilitated by the framework. The comparison and contrasting process of criminal activities offended in different cases may lead to new profound insights into the phenomenon.
- Von Lampe (2012) and Arsovska (2008) also describe the difficulty in validating theoretical frameworks empirically in the burgeoning field of organised crime. They assert that good quality data and a rigorous research design are required to demonstrate the validity and reliability of the framework.

The research question related to research issue II, is as follows:

- "Can an overarching framework/model be used by international research community and law enforcement agencies to effectively investigate organised crime activities?" (Research question 4).

This question is discussed and addressed in detail in chapter 7.

Based on the nature of the research issues, a multi-methodological approach is required to solve above listed challenges and problems. Two core methodologies have been chosen for this research project, they are:

- Qualitative Methodology
- Design Science Methodology

Each of these methodologies is discussed in more detail in the next section.

5.4   Research Methodology

The foregoing sections briefly emphasized the epistemology of this research project, that is, the exigency to investigate organised crime in a more effective and efficient manner. The ontology relating to this project is focusing on organised crime that has become extremely diverse, lethal and sophisticated and as a consequence, new frameworks, models, methodologies and investigative methods are urgently required. Moreover, the lack of information on the modus operandi and inter/intra group behaviour increases the level of difficulty and complexity to investigate and propose new investigation alternatives. In addition to these shortcomings, it is also extremely onerous to find suitable variables to measure the methods and behaviour of organised crime groups; in the event where these measures are available, they are interwoven with one another, and are very complex.

According to Martin (2008), the two most common research techniques used to investigate complex and wicked real-life events, are called quantitative and qualitative research designs. In quantitative designs, the value of the measures under consideration is quantified in order to make an astute inference. For qualitative designs, research topics which cannot easily be quantified are researched naturalistically, and patterns of behaviour are sought.

Davidsson (2016) concurs with Martin (2008) and suggests that research questions which are inherently qualitative in nature are best answered by qualitative research techniques. Liamputtong (2013) also agrees with Davidsson (2016) and Martin (2008), but adds that qualitative research focuses predominately on social world facets instead of the world of nature. Moreover, according to Liamputtong (2013) and Creswell (2012), this research technique has proven itself to be highly successful in studying research problems inquiring into the importance and implication of individuals or groups ascribed to a social or human problem, such as organised crime.

Thus, in order to examine and address research issue I, it is argued to exert the qualitative research technique due to its strong focus on unravelling social world dilemmas and qualitative nature of the potential source data.

In terms of the second research issue, that is, the absence of a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently, the researcher considered various problem-solving paradigms. According to Hevner et al. (2004), certain paradigms such as design science research, are mainly concerned with the methodological search to create innovations or solutions that could define substantive ideas, models, practices, technical capabilities and products to be used to resolve real-world problems.

Venable and Baskerville (2012) concur with Hevner et al. and highlight that design science research focuses predominantly on inventing new purposeful artifacts to address generalised type of problems and evaluates the utility of the artifacts. Purposeful artifact in this context includes systems, methods, methodologies, procedures, models, practices or any other technology that can be exerted to resolve the problem of concern.

Furthermore, March (2008) highlights the growing acceptance for the use of design science research as a problem-solving paradigm within the field of Information Technology. Two of the main reasons for the acceptance are the mature anatomy of the design theory and the rigorous evaluation of the developed artifacts. The evaluation relates to the measuring of the effectiveness and efficiency of the artifact within the natural environment where it will be deployed.

Due to the potential ability to resolve real-world problems, mature structure of the science and the rigorous nature of the evaluation process, it was decided to adopt design science research to address research issue II. Both qualitative research and design science research are discussed next in terms of the research methodology that is to be followed to address the respective research issues.

5.4.1 Research Methodology I: Qualitative Research

The pervasive adoption of qualitative research in the field of psychology and sociology as an alternative to quantitative research stem from its ability to gather intelligence when little knowledge about a phenomenon under investigation is known (Liamputtong, 2013, p.xiii). As qualitative research has its roots in American sociology and anthropology, it is governed by certain principles in the form of methodological frameworks. According to Liamputtong (2013) and O' Reilly & Parker (2012), there are many frameworks available to conduct qualitative research, such as Ethnography, Phenomenology, Symbolic interactionism, Hermeneutics, Feminist methodology, and so forth.

As the aim of this research methodology is to study, among others, the modus operandi and behaviour of individuals within the organised crime groups and outside the groups, the phenomenology methodological theory is selected as the framework to investigate organised crime and to gather important information. Also, as highlighted by Liamputtong (2013), phenomenology provides a theoretical perspective that attempts to generate knowledge about how individuals experience group activities within their particular environment. Therefore, the aim of this methodological theory is to understand and articulate the participants' experiences of their everyday world that include their activities in the organised crime group.

Phenomenological studies employ a variety of different data collection and analysis methods, such as in-depth interviews and documentation observations, including context analysis on case studies, to analyse data for specific themes (Liamputtong, 2013, p.8; Fusch & Ness, 2015, pp.1409-1410). Due to the lack of criminal participants available for this research project, it was decided to opt for case study research method as it allows for gathering knowledge about how individuals operate in group format without interviewing them. Creswell (2012), Yin (2012) and Liamputtong (2013) stress that case study research is in particular well suited for studying a phenomenon within one or more bounded systems (cases), hence making it highly suitable for analysing and investigating organised crime. Meyer (2001, in Liamputtong) elaborates further by highlighting the value of case study research for discovering new behaviours, processes or any other issues where there is little

knowledge thereof. Yin (2003, in Liamputtong) agrees with Meyer and concludes that case studies are the preferred research method when "how" and "why" questions are being posed, when the researchers have little control over events, and when the focus is on a contemporary phenomenon within a certain real-life context. Since case study research method provides a solid platform to explore social real-life events, and it is well suited for the provision of explanatory answers, it was decided to implement case study research as the method to generate a detailed description of the organised crime phenomenon by analysing limited data sources.

Moreover, a purposive sampling strategy for this method is adopted. Liamputtong (2013), highlights that qualitative research is predominately concerned with in-depth understanding of the issue under examination. Hence, it samples for meaning, rather than frequency. Both Liamputtong (2013) and Fusch & Ness (2015) claim that a crucial point in qualitative research is to select the correct amount of cases to analyse. They asserted that sampling should be conducted in a meaningful and strategic way, rather than attempting to make statistical comparisons or to create a representative sample (Liamputtong, 2013, p.18; Fusch & Ness, 2015, p.1409). In phenomenological research, the terms meaningful and strategic are governed by quality and not size (Liamputtong, 2013, p.18). The concept of data saturation is exerted to determine the number of case studies. Ten Australian and one international based organised crime cases are selected, which have led to a saturation point where no obvious new data were generated.

For each of the eleven case studies, a number of secondary and tertiary sources are used. Milward and Raab (2006) define appropriate secondary and tertiary sources as court transcripts, congressional hearings, newspaper articles, or insider books; all are used to gather data about criminal organisations. Following their recommendation, for this project a number of publicised court indictments and on-line newspapers are used to construct cases for each case study.

Creswell (2012, in Liamputtong), Stake (2005, in Liamputtong) and Liamputtong (2013) suggest a six steps process in conducting the case study research method, namely:

5.4.1.1 Problem Definition

> The aim of this step is to verify that case study research method is suitable for the research question/s under consideration. In terms of this research methodology, the research questions under consideration relate to research issue I. Liamputtong (2013) asserts that case study research method is in particular well suited for research issues with a bounded system (i.e. cases) and where little information is known about the research issues. Lawler (2010) claims that many authorities possess limited knowledge about organised crime groups, which includes knowledge about basic activities to more complex transnational activities, as well as knowledge about how organised crime organisations diversify their activities to maximise profits. Nonetheless, he and other venerable authors, such as von Lampe (2012),

also highlight that much more information is required to fully comprehend the phenomenon.

Moreover, Morrison (2002) and Allach (2011) argue that organised crime activities are largely conducted within a bounded system environment to maximise the profit and minimise the risk of exposure. Importantly, crime in general is naturally investigated on a case by case basis and Liamputtong (2013) highlights that case study research is extremely well suited for exploring knowledge from offenders who committed criminal acts. Therefore, it could be argued that case study research is indeed well suited to address this research issue.

5.4.1.2 Case Study Design

Based on the problem definition in the preceding step, this step is concerned with the selection of suitable criminal cases. Criminal cases for this project are constituted with several individuals in a structured group environment that perform illegal activities as outlined in the various criminal acts and codes. Therefore, the focus of each case relates to single or multi criminal activities, perpetrated between January 2010 to December 2015. Liamputtong (2013) suggests selecting cases that show different perspectives of a research issue is best suited to explore maximum knowledge about a research issue. For this reason, eleven Australian and one international based organised crime cases are selected, each of them focussing on a different organised crime activity, such as murder, robbery, fraud and so forth.

5.4.1.3 Data Collection

Next, the data for each case is collected and organised in a meticulous mode. For this project, applicable court indictments, court summary documents and news articles are collected for each case. Thereafter, the data is combined in a chronological fashion to detail the narrative of the case. Where possible, three unrelated sources of data have been selected to enable triangulation of facts and to ensure appropriate rigour in the qualitative research design.

5.4.1.4 Content Analysis

During this step, the data for each case is coded and recorded in a spreadsheet codebook. In order to code each case, a coding schedule has been prepared to serve as baseline for all cases under investigation. The list of variables, as outlined in table A1 in appendix A, are included in the coding schedule with a detailed explanation of each variable, as well as instructions pertaining to the coding process. The coding schedule is included in appendix B.

The final part of this step relates to the piloting of the coding schedule, which includes peer reviewing. The purpose of this activity is to ensure that the coding schedule is comprehensive and non-ambiguous, as well as to validate that the capturing process of the data is conducted in a constant and normative subjective manner (Liamputtong, 2013, p.33). The NVIVO context analysis software is being

used to discover and capture data on the different variables in each case. For this project, a mini-case is coded by both the principle researcher and the promoter who has extensive experience in qualitative research; the results are included in appendix B. The Krippendorff's Alpha(α)-reliability coefficient is used for the reliability testing. A α-reliability coefficient of 0.663 was found, which illustrates significant inter-rater reliability and validity in terms of the data collection and analysis process (see sections 6.2.4 and 6.3.5 for more detail) (McHugh, 2012; Armstrong et al., 1997, p598).

5.4.1.5 Assessment and Interpretation

The assessment and interpretation of the captured data is conducted according to the five steps exploratory approach in table 4.6 in chapter 4. AutoMap in the ORA software package is exerted to operationalize and automate the assessment and interpretation process.

5.4.1.6 Reporting

The meaning of the outcome of each case individually and the holistic meaning of all cases together are reported in chapter 6. Furthermore, the report in chapter 6 includes a brief articulation of which of the twenty-eight variables are most suited to determine nodes and relationships of organised criminal activities (relates to research question one), which theory or approach to behaviourism best explains and predicts individual and groups behaviour of those involved in organised crime (relates to research question two), and whether criminals follow a unique methodology while conducting organised crime (relates to research question three).

5.4.2 Research Methodology II: Design Science

As concluded above, the design science research methodology has been adopted to address research issue II. Design science research is well recognised in the Information System literature and has a solid theoretical and practical foundation to solve research issue II, as it is fundamentally a problem-solving paradigm that has its roots in engineering and the sciences of artificial (Hevner et al., 2004, p.76). It predominantly seeks to create innovative artifacts, such as purposeful ideas, practices, technical capabilities, models and products through which the analysis, design, implementation, management and use of technology can be effectively and efficiently accomplished (Venable & Baskerville, 2012). Moreover, the purposeful artifacts also enable researchers to understand and address the problems/challenges inherent in developing and implementing real-world solutions (March & Smith, 1995; Nunamaker et al., 1991).

There are a number of methods which could be followed to create purposeful artifacts, such as the design cycle (DC) method of Vaishnavi & Kuechler (2004), action design research (ADR) method of Sein et al. (2012) and the design science research process (DSRP) method of Peffers et al. (2008). Although all of the mentioned methods have many similarities

amongst them, it was decided to adopt the DSRP method due to the smaller incremental steps of design and the multi entry points into the research design.

The DSPR method comprises six stages, namely:

- Problem identification and motivation;
- Objectives of a solution;
- Design and development;
- Demonstration;
- Evaluation; and
- Communication.

Each of these steps is articulated next, with the focus on addressing research issue II.

5.4.2.1 Problem Identification and Motivation

The overall research problem definition and motivation for this research project has been articulated in detail in section 5.2. However, the research problem related to research issue II is formulated as: The absence of a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently. Morrison (2002), among others, asserts that the absence of a holistic universal framework is also adversely impacting research on organised crime. More importantly, the current lack of such framework/model may lead to the development of ineffective strategies, technical measures and operational procedures, as new criminal enterprises emerged, the motivation of the groups are changing over time, the activities of the group are stream-lined and new technologies become available for these perpetrators. Therefore, the developed artifacts ought to take into account the dynamic environment of organised crime and should be adaptive, versatile and grow in maturity over time to be in line with the current and future trends of the complex phenomenon.

5.4.2.2 Objectives of a Solution

The objective of the solution is two-fold, namely:

- To provide a baseline to research the environment in which organised criminal organisations thrive, which include among others, structures, relationships, operational processes adopted within the groups, and the social, political and economic impacts of the groups.
- To offer a platform to law enforcers, security agents and policymakers to debate and define effective strategies, technical measures and operational procedures.

5.4.2.3 Design and Development

The aim of this stage is to create the artifactual solutions in order to address research issue II. Two artifacts are created, namely, conceptual framework and prototype. In terms of the conceptual framework, it is based on a number of inputs,

processing and output concepts or modules. The architecture and functionalities of the framework are articulated in chapter 7 in more detail. With regards to the prototype, the aim of this artifact is to operationalize the conceptual framework and to demonstrate how researchers, law enforcers, security agents and policymakers can debate and define effective strategies, technical measures and operational procedures.

5.4.2.4 Demonstration

According to Peffers et al. (2008), one of the fortes of DSRP method is the demonstration of the efficacy of the artifact in solving the research issue. For this project, a case study is applied to demonstrate how the proposed model can be employed, as well as the effectiveness thereof.

5.4.2.5 Evaluation

The evaluation stage encompasses the observation and measuring of how well the artifact supports the solution to the research problem. This activity mainly involves the comparison of the objectives of the solution as defined in section 5.4.2.2 against the actual observed results gathered in the demonstration of the artifacts. From a practical perspective, the evaluation includes the qualitative analysing of the output of the artifacts in terms of their functionalities to determine whether or not the artifacts can address the research problem.

5.4.2.6 Communication

The development of the prototype, the demonstration of effectiveness of the artifacts and the evaluation process are described in chapter 8. Furthermore, the utility and novelty of the solution is briefly highlighted in chapters 8 and 9. As a capstone for this project, the artifacts, utility, novelty and effectiveness of the solution are also communicated to the research community via a scholarly research publication.

The two chosen methodologies to address the respective research issues were introduced, discussed and motivated. The qualitative research methodology is adopted to address research issue I, as a result of its rigorous and mature frameworks and ability to extrapolate knowledge from subjects where very little information is available. Moreover, this methodology employs a variety of different data collection and analysis methods, of which case study method is selected due to its strong focus on bounded systems or examination cases, and the natural investigation boundaries of crime (i.e. criminal cases).

Design science research methodology is espoused to address research issue II. As highlighted by Peffers et al. (2008) and Hever et al. (2004), this methodology is well suited to deliver practical and effective solutions due to its engineering roots and rigorous methods. Further on, the design science research process method is employed as the vehicle to design, develop, demonstrate and evaluate the solution for this research issue.

5.5   Conclusion

As underlined by Liamputtong (2013), well-developed research methods permit for shrewd uncovering and understanding of facts associated with any phenomenon about which little is yet known, or to gain new knowledge about important aspects of which quite a bit is already known. However, in order to extract knowledge through research, there is a requirement to identify the appropriate combination of approaches, methods, techniques and tools, as well as to apply them in a rigorous and valid way (Nunamaker, Chen and Purdin, 1991). Furthermore, according to Dew (2007), the process of unearthing knowledge is guided by a research methodology; the research methodology also determines the research methods used to produce data for analysis (Laimputtong, 2013, p.6).

The focus of this chapter was to vividly define the research problems and issues pertaining to organised crime, to identify suitable research methodologies to address the defined problems and issues and to select the most appropriate research methods relating to each research methodology.

The first part of the chapter concentrated on two research issues: Insufficient data and information to investigate organised crime, as well as the unavailability of a holistic overarching framework/model for investigating organised crime. The main reasons for having these two research issues are related to the complexity of the phenomenon, lack of opportunities to interview alleged or convicted offenders, non-cooperative international crime investigators and uncoordinated international research efforts.

The second part of the chapter elaborated on how these two research issues are addressed in this thesis. Based on the nature of the research issues, a multi-methodological approach is adopted, which includes both qualitative research methodology and design science research. It was argued that qualitative research overseen by the phenomenology theory is well equipped to address the insufficient data and information research issue. It was further claimed that case study research method should be used to extrapolate suitable data and information from public data sources, which relate to a number of diverse substantive organised crime cases. Finally, it is highlighted how design science research through the design science research process (DSRP) method is to be used to create a holistic and overall model to investigate organised crime.

In the next chapter, the qualitative research methodology and case study method are outlined in more detail. The six steps approach, as articulated in section 5.4.1, is further elaborated on that includes a comprehensive discussion on the results of the content analysis process.

Chapter 6

The Case Study

The Case Study

This chapter focuses on:

- Delineating the aims for the case study;
- Articulating the method used to conduct the case study;
- Presenting the overall results for the case study; and
- Discussing the results and evaluating them against other applicable theories.

6.1   Introduction

The previous chapter underlined the identified research problems and issues related to organised crime and this project, as well as the two selected research methodologies, i.e. qualitative research and design science methodologies. The applicable research problems and issues related to this chapter are put forward and theorised by the first three research objectives of this project, namely:

- What are the *critical attributes* (independent variables) necessary for investigating nodes and relationships of organised criminal groups and activities?" (Research question 1);
- Which *theory or approach to behaviourism* best explains and predicts individual and groups behaviour of those involved in organised crime? (Research question 2); and
- Do criminals follow a *general and typical methodology* while conducting organised crime and can it assist further with the investigation of criminal cases? (Research question 3).

Qualitative research and especially case study research method has been used by researchers for many years to discover new behaviour, processes or general knowledge in anthropology, social work, education and law (Liamputtong, 2013, p.199 – 207). In particular, qualitative research has become prominent in criminology since the 1970s, especially for exploratory research, mainly due to the gradual shift in focus from statistics that indicate specific types of crime to more contemporary studying of interaction processes within the criminal environment (Meuser & Löschper, p.1-3, 2002).

Qualitative research, governed by the phenomenological framework, is exerted to research the three research objectives. In terms of research objective one, the list of twenty-eight variables identified in chapter three serve as baseline for the research. However, additional variables are also considered. With relation to research objective two, the assertion of Akers (1999) that both social-psychological and sociological theories are most suitable to describe grouped criminal behaviour, is used as a starting point to determine which behavioural theory best describe the behaviour of organised crime offenders. In regards to research objective three, the general and typical methods

and actions employed by organised crime offenders is examined to get a better understanding of how they commission the criminal events. Ultimately, the aim of addressing these research objectives is to create an exploratory model and practical prototype, which could be used by both researchers and possibly law enforcers to scrutinise, prosecute and prevent organised cases in the future. This goal is addressed in subsequent chapters.

In criminology, the methods and actions carried out by offenders are studied under the overarching concept called modus operandi (Daniels et al., 2016, p37; Munasinghe et al., 2014, p265; Klima, 2012, p94). Munasinghe et al. (2014) claim that modus operandi is mainly concerned with the study of how the crime was organised, executed and absconded. Hazzelwood and Warren (2009) define modus operandi as "the various behaviours that are requisite for a particular offender to successfully accomplish a crime". Daniels et al. (2016) agree with both definitions and conclude that modus operandi represents the behaviour, actions and methods of the individual that constitute the holistic crime event.

The researchers further classify the behaviour, actions and methods of criminals as either: general, typical, variant and unique. Most of the research on modus operandi is conducted on an offender and/or offence type basis, for example sex offenders, rapist, robbers, human trafficking, homicide, assault and so forth (Daniels et al., 2016, p38). For each of these offence types, the general, typical, variant and unique actions and methods are listed in order to get a better understanding of the crime event. As the aim of this research objective is to ascertain a general and holistic modus operandi that extrapolates actions and methods executed by most offenders in a variety of offence types, the general and typical actions and methods only is examined in this research project.

The main purpose of this chapter is to confirm the useability of the listed independent variables to represent the core aspects of organised crime cases accurately. Further to that, it also attempts to emphasize the effectiveness and efficacy of the four categories of variables, i.e. traditional, social-psychological, sociological and social network variables, in terms of contributing facts and information to conclude an outcome of each case.

The chapter commences with a discussion on the qualitative research method used in this research project to address research questions one to three. This is followed by the articulation of the acquired results from the content analyses on eleven selected cases' source documents, together with a discussion on the findings of the study. The chapter then concludes with a short summary.

6.2   Method

A qualitative research methodology that employs case study method is implemented to address the three research objectives. The case study method follows a comprehensive and well-structured case study design, which is described in this section below.

6.2.1   Setting

One of the primary objectives of the qualitative research is to make a determination in terms of how effective the selected variables are in terms of understanding, scrutinising and making possible inferences. This is achieved through the operationalization of the independent variables, by applying them to substantive cases, which were randomly selected. Eleven cases are nominated, three of which were trialled in Western Australia, six in other states in Australia and one international case. One of the eleven cases is also used to determine inter-rater reliability. Source data for each case was obtained from Westlaw Database under the standard student agreement and myriad of publicly-available news articles from various news agencies across Australia were used to triangulate and enhance data quality. The average page length for the court summary documents amounts to 36 pages per case; in most cases, they provided comprehensive accounts of the criminal acts.

6.2.2   Participants

No in-person participants contributed to the research project; the court summary documents and news articles portrayed applicable information on 54 offenders, 182 witnesses and 402 victims. Personal details of participants are anonymised as far as possible by referring to offender A, B and so forth. At the time of searching the database, round about 100 cases met the search criteria, which included among others, organised crime and date of court appearance. Important factors taken into consideration whilst determining the sample size for this study are: firstly, qualitative research is more focused on discovering new quality (rich) information rather than quantity of cases (Liamputtong, 2013, p.18; Fusch & Ness, 2015, p.1409), and secondly, O'Reilly & Parker (2012) emphasize that sample size for a qualitative study is predominantly determined by data saturation.

Consequently, it was decided to sample about 10% of the available cases diligently. After executing the content analysis research method on the selected cases, data saturation was achieved (i.e. no new data was discovered and no new themes were unearthed). Moreover, the chosen sample size is further validated by studying other similar research projects in the field of organised crime, such as "The disruption of organised crime groups" by Kirby & Snow (2016), which also utilize relative small sample sizes for analysing important aspects of the phenomenon.

The eleven cases under consideration are as follows:

- Offender A v State of Queensland, [2016];
- Offender A v The Queen, [2014];
- Offender A v The Queen, [2013];
- Offender A v The State of Western Australia, [2015];
- R v Offender A, [2014];
- R v Offender A and Others, [2011];
- R v Offender A, [2010];
- R v Offender A; R v Offender B; R v Offender C, [2014];
- Offender A v The Queen, [2015];
- Offender A v The Queen, [2014]; and

- R v Offender A, [2014].

The data sampled from the eleven cases above cannot be generalised to organised crime as a whole in Australia as the sample size is statistically insufficient. However, the extent of the demographical variables is comparable to other samples of recorded crime articulated in literature, which highlights the relevance of the data set. Exemplary comparable sources include, the ABS's Recorded Crime—Offenders, Selected States and Territories 2014-2015 (Australian Bureau of Statistics, 2016) and Australian Institute of Criminology – Facts and Figure 2014 (Australian Institute of Criminology, 2016).

For instance, the population of offenders for the eleven case studies comprise 90% males and 10% females. According to the Bureau of Statistics, the overall composite of offenders for all types of crime in Australia encompassed 78% male and 22% female for the 2014-2015 reporting year. Also, the mean age of the offenders for the eleven cases was ranging in the '31 – 45' category. The mean age of offenders for all categories of crime in Australia for the 2014-2015 reporting year was 28 years and was on the rise by 3% from the previous year (Australian Bureau of Statistics, 2016).

6.2.3   Data Collection: Questionnaires and Coding

The questionnaire exerted for this research study comprises 64 questions related to each of the listed variables tabled in Appendix C. The questionnaire encompasses both semi-open ended and closed questions to encourage unearthing of new knowledge and allow for sensible comparison and contrasting between the different cases. The findings of each case are recorded in an Excel spreadsheet to allow for meaningful inferences.

The questionnaires are completed by using content analysis according to the procedure suggested by Kvale (1996) and Liamputtong (2013). As per the procedure, the researcher has reviewed the court summary documents and selected news articles several times to discover the narrative of each case and clearly identify the key role players. Thereafter, NVIVO software was used to do the coding of each document. Each of the variables was categorised as separate headings, and all related information was collated under the respective heading and sub-heading. Where possible, three sources of data, for instance three discrete independent news articles, have been selected to enable triangulation and to ensure appropriate rigour in the qualitative research design.

This is followed by reviewing the code, after which it was tabled manually in the respected spreadsheets. The results are captured in appendix B and table 6.1. The tables in appendix B reflecting on the actual data captured from each case, whilst table 6.1 synopses the relevancy of the various variables based on the actual data, i.e. variables were scored as either relevant data (constitutes to 1) or irrelevant or no data (constitutes to 0). Subsequent to the tabling of the data, the researcher also considered the definition of

organised crime, the holistic taxonomy as compiled in chapter 2 and the various criminal theories as outlined in chapter 3 to analyse the data further.

6.2.4   Statistical Analysis

Frequency distributions and descriptive statistics (means and standard deviations) are used to determine the overall relevancy of the variables and effectiveness of the existing crime variables and theories, in order to make holistic inferences. For this reason, the data was analysed by using Excel software for Windows.

Excel software is also used to calculate the inter-rater reliability coefficient by computing both the mathematical observed and statistical agreed measures.   The mathematical observed agreement measure compares the answers of both the researcher and researcher assistant, and then calculates the mathematical comparison between the sets of answers. For this study, the observed mathematical reliability equals to 73%.

The Krippendorff's Alpha(α)-reliability coefficient is applied, on the other hand, to evaluate the level of agreement by taking into account the random chance that the raters agreed to a question due to the structure of the questionnaire (Krippendorff, 2011, p.1).   The Krippendorff α statistic is often used in content analysis to calculate the reliability of coders or raters in order to truly answer the question of how much the resulting data can be trusted to represent the domain of concern (Krippendorff, 2011, p.1). This statistic is carefully chosen above other common statistical measurements, such as Cohen's Kappa, as it could be used to measure rater's reliability where the questionnaire has a high number of categories, scale values and measures, as well as in cases where the sample size is relatively small (Krippendorff, 2011, p.1).

All answers are preserved as nominal data; consequently, the *nominal data, two observers, no missing data* calculation method is used to compute α-reliability coefficient.   The α-reliability coefficient is computed with the following equation:

$$\alpha = \frac{(n-1)\sum_c o_{cc} - \sum_c n_c(n_c-1)}{n(n-1) - \sum_c n_c(n_c-1)} \qquad\qquad \dots \qquad 6.1$$

For this study, a α-reliability coefficient of 0.663 (or normalised to 66.3%) was calculated, which illustrates statistical significant inter-rater reliability and validity in terms of the data collection and analysis process (McHugh, 2012; Armstrong et al., 1997, p598).   Please see table 6.5 below for more details.

The nomenclature and activities of the case study design has been briefly articulated in this section. As stated, eleven distinct organised crime cases are investigated by means of a 64-quizze questionnaire.   Frequency distributions and descriptive statistics are used to make inferences in terms of the three research objectives.   Having delineating the case study design, the next section will now articulate the results of the study in terms of the three research objectives.

6.3   Results

Now that the case study design is articulated above, the focus is shifting towards the results obtained from the study. Subsequently, this section reports the results of the study by focusing on the useability of the listed variables, the importance of each variable in relation to articulate the case, the effectiveness of behavioural theories in terms of the variables and the existence of a general modus operandi for organised crime criminals. Each sub-section is highlighting the most important facts obtained through the study.

6.3.1   Evaluating the Listed Variables

In terms of the useability of the listed variables, the original twenty-eight variables as listed in chapter 3 were used as baseline to evaluate the first case. Whilst analysing the first case, it became apparent that additional variables are required to further comprehend and represent the case. Aspects such as chronological time-lines, evidences, sentences and punishments were highlighted as important general variables. For this reason, three more generalised variables were added to the list of independent variables, which include variable 31 - *Miscellaneous Information*. This variable was utilized to capture new additional information, especially from the prosecution's perspective, and was also exerted to determine when the data saturation point was reached. See appendixes B and C for further information regarding the thirty-one variables.

The corollary of the study in terms of whether information could be found to populate each variable is listed in table 6.1. The study of the eleven cases has revealed that all thirty-one variables could be employed in one or more cases to highlight important aspects of the case. It further pointed out that variables 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 23, 24, 25, 27, 28, 29 and 30 are the most frequently reported variables (100%), while variable 31 is the least frequently stated variable (27%). As the list of variables became more mature, less new information was reported, resulting in the low citation value for variable 31. The second lowest reported variable is variable 22 – Family culture (36%). This means that aspects of family culture were the least referred to by the prosecution, judges and crime reporters; therefore, it has the least impact on the judgement, sentencing and reporting of the relevant alleged offenders.

Furthermore, 88% of the variables were reported on average for all eleven cases – highlighting the relevancy of each variable and the comprehensiveness of the list of variables. Also, the mean standard deviation for all variables and cases amount to 17%, which further emphasizes the constant reporting value of each variable. As a consequence, variables 1 – 30 are deemed suitable and important to scrutinise, interrogate and understand organised crime cases.

Ref No.	Variable Description	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11 - Code Reliability Test	Mean Value for Variables	Std Dev Value for Variables
1	*Variable 1 - General*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
2	*Variable 2 - Type of Crime - Serious*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
3	*Variable 3 - Type of Crime - Non-Serious*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
4	*Variable 4 - Weapon*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
5	*Variable 5 - Age*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
6	*Variable 6 - Gender*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
7	*Variable 7 - Race*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
8	*Variable 8 – IQ*	0	1	0	1	1	0	1	1	1	1	1	0.73	0.47
9	*Variable 9 - Relationship of Victim to Offender*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
10	*Variable 10 - Differential Reinforcement*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
11	*Variable 11 - Definitions*	0	1	0	0	1	1	1	1	1	1	1	0.73	0.47
12	*Variable 12 - Imitation*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
13	*Variable 13 - Social Structure*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
14	*Variable 14 - Attachment*	1	1	0	1	1	1	1	1	1	1	1	0.91	0.30
15	*Variable 15 - Involvement*	1	1	0	1	1	1	1	1	1	1	1	0.91	0.30
16	*Variable 16 - Informal Label*	1	1	1	1	1	1	1	1	1	1	0	0.91	0.30
17	*Variable 17 - Goal Disappointment*	0	1	0	1	1	1	0	1	1	1	1	0.73	0.47
18	*Variable 18 - Removal of Positive Stimuli*	0	1	0	1	1	1	0	1	1	1	1	0.73	0.47
19	*Variable 19 - Exposure to Negative Stimuli*	0	1	0	1	1	1	1	1	1	1	1	0.82	0.40

20	*Variable 20 - Family Structure Philosophy*	0	0	0	1	1	0	0	1	1	1	0	0.45	0.52
21	*Variable 21 - Capitalistic Economic System*	1	1	1	1	1	0	1	1	1	1	1	0.91	0.30
22	*Variable 22 - Family Culture*	0	0	0	0	1	0	0	1	1	1	0	0.36	0.50
23	*Variable 23 - Roles*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
24	*Variable 24 - Status*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
25	*Variable 25 - Official Communication Policy*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
26	*Variable 26 - Degree of Autonomy*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
27	*Variable 27 - Social Support*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
28	*Variable 28 - Resources*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
29	*Variable 29 - Others*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
30	*Variable 30 - Attitude Towards Victims*	1	1	1	1	1	1	1	1	1	1	1	1.00	0.00
31	*Variable 31 - Miscellaneous Information*	1	1	0	0	1	0	0	0	0	0	0	0.27	0.47

Table 6.1: The Relevancy of Each Variable per Case Basis.

6.3.2 Determining the most Important Variables (Most Reported Variables)

A further method implemented to evaluate the listed variables in terms of which ones are more important in describing the organised crime case, is to analyse the most common theme in each case. Tables 6.2.1 to 6.2.4 outline the results of this study on a case-by-case basis. The results are also aggregated to find the overall most important themes and variables for the study and are depicted in table 6.2.5. Details of the offenders are a sub-category of variable 1 and are highlighted throughout the eleven cases. This theme is one of the five most reported themes in ten of the eleven cases and is repeated 2215 times in the ten cases, which highlights the natural strong focus on details of offenders by the prosecution, judges and crime reporters. The next most reported theme, the location where the criminality was committed, is reported on 513 times in eight cases. This theme is also a sub-category of variable 1.

Sentencing is another important theme in all of the cases and relates to variable 29. It is listed as one of the five most reported themes in seven cases and is repeated 623 times in the seven cases. This is followed by the offence/criminality theme, which refers to variables two and three. This theme is recorded 1122 times in six cases. Another important theme apparent in all of the cases pertains to the evidence element of crime. The evidence theme is a sub-category of variable 29 and is repeated 1310 times in five of the cases.

Other important themes reported on significantly in the study include: Periods when crime is committed (top five theme in four cases), Witnesses (top five theme in two cases), Trail information (top five theme in two cases), Resources (top five theme in two cases) and Victims (top five theme in one case). Therefore, based on the findings listed in table 6.2.5, variables 1, 2, 3 and 29 are the most reported variables in terms of court summary documents and news articles related to the eleven cases.

Case 1				Case2				Case3			
Ranking Order	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable		
1	Offender	233	Variable 1	Victims	328	Variable 1	Offence	467	Variable 2		
2	Evidence	187	Variable 29	Offence - Smuggling	268	Variable 2 & 3	Sentence – Penalty	214	Variable 29		
3	Offence - Illicit Products/Drugs	106	Variables 2 & 3	Location Where Offence was committed - Australia	125	Variable 1	Location Where Offence was committed – Australia	197	Variable 1		
4	Criminal Activities - Production of Illicit Products/Drugs	57	Variable 1	Sentence	73	Variable 29	Offender	181	Variable 1		
5	Location where Criminality was committed - Notch	47	Variable 1	Weapon - Vessel	39	Variable 4	Law	134	Variables 2, 3 & 29		

Table 6.2.1: The Five Most Common Themes in Cases One, Two and Three Related to the Listed Variables.

Case4				Case5				Case6			
Ranking Order	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable		
1	Appeal	122	Variable 29	Evidence	581	Variable 29	Evidence	253	Variable 29		
2	Offender	98	Variable 1	Offender	260	Variable 1	Witness	200	Variable 1		
3	Sentence	48	Variable 29	Witness - Police	140	Variable 1	Offender	175	Variable 1		
4	Location Where Offence was Committed – Australia	29	Variable 1	Offence - Attack	68	Variable 2 & 3	Location Where Offence was Committed – Airport	73	Variable 1		
5	Period when Committed Crime	25	Variable 29	Motive	61	Variable 1	Joint Criminal Enterprise	44	Variable 2 & 3		

Table 6.2.2: The Five Most Common Themes in Cases Four, Five and Six Related to the Listed Variables.

Case7				Case8				Case9			
Ranking Order	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable
1	Offender	139	Variable 1	Offender	83	Variable 1	Offender	781	Variable 1
2	Trial Information	104	Variable 29	Sentence	54	Variable 29	Evidence	259	Variable 29
3	Sentence	32	Variable 29	Offence - Attack	31	Variable 2 & 3	Trial Information	169	Variable 29
4	Location Where Offence was Committed - Licensed Premises.	31	Variable 1	Timeline - Time Period of Activities.	17	Variable 29	Offence	153	Variable 2 & 3
5	Evidence	30	Variable 29	Location Where Offence was Committed - Australia	11	Variable 1	Timeline - Time Period of Activities.	90	Variable 29

Table 6.2.3: The Five Most Common Themes in Cases Seven, Eight and Nine Related to the Listed Variables.

Case10				Case 11 - Code Reliability Test			
Ranking Order	Theme	Count	Applicable Variable	Theme	Count	Applicable Variable
1	Offender	133	Variable 1	Sentence	135	Variable 29
2	Resources - Money	130	Variable 1	Offender	132	Variable 1
3	Sentence	76	Variable 29	Resources - Money	81	Variable 1
4	Offence	60	Variables 2 & 3	Timeline - Time Period of Activities.	38	Variable 29
5	Proceeds of Crime	41	Variables 2 & 3	Crime	32	Variables 2 & 3

Table 6.2.4: The Five Most Common Themes in Cases Ten and Eleven Related to the Listed Variables.

Ref No.	Theme	Cumulative Count	Applicable Variable	Number of Cases - Top Five Theme
1	Offender	2215	Variable 1	10
2	Location where Criminality was committed	513	Variable 1	8
3	Sentence	632	Variable 29	7
4	Offence	1122	Variables 2 & 3	6

5	Evidence	1310	Variable 29	5
6	Period when Committed Crime	170	Variable 29	4
7	Witness	340	Variable 1	2
8	Trial Information	273	Variable 29	2
9	Resources - Money	211	Variable 1	2
10	Victims	328	Variable 1	1

Table 6.2.5: The Overall Ten Most Common Themes Related to the Listed Variables.

6.3.3 Evaluating existing Crime Variables and Behavioural Theories

Next, the effectiveness of the variables is evaluated in terms of the behavioural theories as observed while analysing the eleven cases. For this exercise, the variables are categorised as traditional crime variables, social-psychological variables, sociological variables or social network variables. Consequently, variables 1 to 9 and 29 to 30 are grouped as traditional crime variables, variables 10 to 16 are clustered as social-psychological variables, variables 17 to 22 are bunched as sociological variables, and variables 23 to 28 are collated as social network variables. The mean value for each group of variables is computed to determine the overall effectiveness of crime variables and behavioural theories.

The findings of the computation process are published in table 6.3. The results revealed that 100% of social network variables and 98% of traditional crime variables are reported on for all eleven cases. Also, 92% of the social-psychological variables are described, while only 67% of the sociological variables are articulated. Therefore, both the social network variables and traditional crime variables are mostly reported on in court summary documents and news articles, whilst sociological variables are described the least of all.

Ref No.	Criminal Explanation and Theories	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11 - Code Reliability Test	Mean Value for Variables	Std Dev Value for Variables
1	*General Explanation of Crime: Traditional Crime Variables*	0.91	1	0.91	1	1	0.91	1	1	1	1	1	0.98	0.04
2	*Social-psychological Explanation of Crime*	0.86	1.00	0.57	0.86	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.92	0.13
3	*Sociological Explanation for Crime*	0.17	0.67	0.17	0.83	1.00	0.50	0.33	1.00	1.00	1.00	0.67	0.67	0.33
4	*Social Network Constructs*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

Table 6.3: The Effectiveness of the Existing Crime Variables and Theories in terms of the Eleven Cases.

6.3.4 Evaluating the Criminal Methodology of Offenders

In relation to the question whether or not offenders follow a general methodology while committing organised crime activities, the study on the eleven cases suggested that the five steps as outlined in the holistic taxonomy are generally being followed by the perpetrators. In most of these cases, the judge referred to meticulous planning, direction and execution of the criminal acts and in some cases, the methodical criminal process served as aggravated circumstances, which led to more severe punishment. Typical criminal activities that epitomised the five phases are listed in table 6.4.

A closer review of the cases in terms of the five generic phases revealed that most organised crime offenders valued the planning and preparation phases, as a large amount of time was devoted to these phases. The planning phase included activities which range from planning the acquisition of products and services to defence explanation in the unlikely event of being detained by law enforcement. The preparation phase was mainly concerned with the acquisition of products, services and weapons to enable the offenders to commit the crime.

Moreover, the duration of each phase has also differentiated significantly between the cases, ostensibly due to the complexity variation of each criminal act and the number of role-players involved. For example, the planning and acquisition phases for one of the cases lasted about two years, while in another case they were limited to two weeks. An international syndicate in at least three discrete countries committed the former case, whilst three perpetrators in one state of Australia committed the latter case. Notwithstanding the significant difference in execution period, the results of the study suggested that one or more of these phases were committed in each of the eleven cases.

Ref No.	Generic Phases and Relevant Activities	Applicable Variables
1	Planning Phase	
	• Planning of travelling routes; • Planning for acquisition of products and/or services; • Travelling between towns, cities or countries to plan criminal acts; • In-person meetings; • High level of communication amongst criminal actors; • Setup of front companies; • Setup of fictitious bank accounts; and • Defence explanation – Spiel used as defence if caught by law enforcement.	Variables 1.2 and 1.7
2	Preparation Phase	
	• Acquiring of substances or services to manufacturing illicit goods; • Acquiring of products or devices to commit the criminal act; • Acquiring of crime weapon; and • Organising and assembling fellow offenders.	Variables 1.2 and 1.7
3	Execution Phase	
	• Manufacturing of illicit products/drugs; • Provisioning of illegal services; • Execution of criminal acts, i.e. murder, manslaughter, affray, riot, and so forth; • Extortion to persuade victims to cooperate; • Corruption activities to support crime syndicates/groups; • Payment of substantial amount, either for illicit goods and/or services or deposits of proceeds of crime; • Travelling to destination where crime will be committed; and • Communicating the results or proceedings of crime to management.	Variables 1.2 and 1.7
4	Direction Phase	
	• Central person directs members of the organisation, either through other members of the group or in-person; and • In a small organisation, the direction stems from a single person; and • In large organisations, such as outlaw motorcycle gangs, a few members provide	Variables 1.2 and 1.7

	direction.		
5	Control Phase		
	In most cases, central person/s control and provide resources, especially finance.		Variables 1.2 and 1.7

Table 6.4: General Activities Accentuating the Five Generic Phases in terms of the Eleven Cases.

6.3.5   Evaluating Inter-rater Reliability of Researcher

Table 6.5 lists the mean mathematical and Krippendorff's α-reliability statistics, which highlights the level of agreement between the researcher and research assistant. Thirty-one variables are measured and compared for case study eleven by both raters and the results are listed in the table. As emphasized before, the overall observed mathematical reliability equals to 73% and the overall α-reliability coefficient amounts to 66.3%.

The Krippendorff's α-reliability coefficient can be evaluated by using the guideline outlined by Landis and Koch (1977). According to Landis & Koch (1977), if the strength of the coefficient equals between 0.01 - 0.20 then it represents slight reliability; 0.21 - 0.40 means fair reliability; 0.41 - 0.60 denotes moderate reliability; 0.61 - 0.80 signifies substantial reliability; and 0.81 - 1.00 means almost perfect reliability. Hence, based on this measurement scale, the Krippendorff's α-reliability measurement (0.663) computed for this project accentuates the researcher's considerable ability to populate the data sets/questionnaires accurately, as well as analysing the cases.

To further comprehend the inter-rater reliability measurement, one can analyse the mathematical agreement measured for each variable in terms of both raters. For case eleven, five variables had no mathematical agreement, three had moderate mathematical agreement, five had substantial mathematical agreement, and eighteen had almost perfect mathematical agreement. Thus, the above average measurements for both Krippendorff's α -reliability coefficient (0.663) and mathematical agreement (0.73) validate the reliability and impartiality of the researcher.

Ref No.	Variable Description	Mathematical Agreement	Overall Agreement
1	*Variable 1 – General*	89.47%	
2	*Variable 2 - Type of Crime – Serious*	100.00%	
3	*Variable 3 - Type of Crime - Non-Serious*	100.00%	
4	*Variable 4 – Weapon*	100.00%	
5	*Variable 5 – Age*	100.00%	
6	*Variable 6 – Gender*	100.00%	
7	*Variable 7 – Race*	100.00%	
8	*Variable 8 – IQ*	100.00%	
9	*Variable 9 - Relationship of Victim to Offender*	0.00%	
10	*Variable 10 - Differential Reinforcement*	50.00%	
11	*Variable 11 – Definitions*	100.00%	
12	*Variable 12 – Imitation*	0.00%	
13	*Variable 13 - Social Structure*	67.00%	

14	*Variable 14 – Attachment*	50.00%	
15	*Variable 15 – Involvement*	67.00%	
16	*Variable 16 - Informal Label*	100.00%	
17	*Variable 17 - Goal Disappointment*	67.00%	
18	*Variable 18 - Removal of Positive Stimuli*	0.00%	
19	*Variable 19 - Exposure to Negative Stimuli*	83.00%	
20	*Variable 20 - Family Structure Philosophy*	100.00%	
21	*Variable 21 - Capitalistic Economic System*	100.00%	
22	*Variable 22 - Family Culture*	100.00%	
23	*Variable 23 – Roles*	75.00%	
24	*Variable 24 – Status*	100.00%	
25	*Variable 25 - Official Communication Policy*	67.00%	
26	*Variable 26 - Degree of Autonomy*	100.00%	
27	*Variable 27 - Social Support*	0.00%	
28	*Variable 28 – Resources*	0.00%	
29	*Variable 29 – Others*	100.00%	
30	*Variable 30 - Attitude Towards Victims*	50.00%	
31	*Variable 31 - Miscellaneous Information*	100.00%	
	Overall Mathematical Agreement		73.08%
	Overall Statistical Agreement		66.30%

Table 6.5: Inter-Rater Reliability.

In brief, the high-level results of the case study were tabled and articulated in this section. These results are used to answer the first three research questions of the project. The next section will elaborate more on these results in terms of other criminal theories and concepts.

6.4 Discussion

The case study analyses on the eleven substantive cases have produced significant results in terms of the three research objectives. The results are collated in tables 6.1 to 6.5 in the previous section and will be further discussed in this section.

6.4.1 Research Objective One: Which Variables are Required to Investigate Organised Crime?

The most frequently reported variables in terms of the eleven cases are variables 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 23, 24, 25, 27, 28, 29 and 30. Each of these variables is reported on in at least one of the source documents in each case and is deemed important to interpret and understand the cases. However, variables 1, 2, 3, 5, 6 and 29 are reported on in almost all of the source documents at least once in all cases, making them the most valuable variables to articulate organised crime cases. This observation is in line with the assertion of Burkhead (2006), which listed variables 5 and 6 as two important general variables to explore

correlation of crime. Burkhead also describes age as the strongest and most consistent relationship with criminal behaviour and Sweeten, Piquero & Steinberg (2013) concur with Burkhead and highlight that age is one of the most robust correlations of criminal behaviour.

Moreover, it is also apparent that most of the older and mature offenders tend to be incumbent in management roles, whereas the younger perpetrators conducted the day-to-day operational and execution (soldier) roles. Thus, in terms of the correlation of crime, the following inferences could be made:

Inference 1: Criminal Responsibilities - In general the senior offenders in the organised crime group will most probably oversee all organisational endeavours and provide direction and control for successful criminal operations. Hence, as underlined by many trial and appeal judges, the senior members of the group are most likely to mastermind and manage the criminal activities and are the main receivers of the proceedings of crime.

Inference 2: Crime Related Workload - The study has also revealed that the soldiers are the workers in the group who are mostly dedicated to one specific criminal enterprise, such as money laundering, drug trafficking and people smuggling. In most cases, these offenders have carried the risk of being apprehended and to protect the organisation, as outlined by Lynman & Potter (2004). This assertion was also underlined a number of times by the trial and appeal judges and has impacted the sentencing of most offenders.

In terms of variable 6, the study has revealed that 90% of the offenders are males. This finding correlates with the claims of Burkhead (2006) that men are always more likely to commit crime at any age compared against females, regardless of crime type, source of data, level of involvement or measurement of participation.

Inference 3: Gender of Organised Crime Offenders - Hence, in relation to the correlation of crimes, any male offender associated with an organised crime group is more likely to commit criminal enterprise activities and should therefore be studied in more detail.

The study has also discovered that all the criminal activities have been committed outside the family domain of the perpetrators, irrespective whether committed by male or female. The data further suggests that most criminality was intra-group related and was committed by members inside a logical group, i.e. similar culture and social norms. For example, criminal activities between two outlaw motorcycle gangs, provisioning of illicit drugs between suppliers and users, human traffic arranged by a former asylum seeker, and so forth. This finding aligns well with the assertion of Akers (1999) that most group crime is intra-group related.

Inference 4: Milieu of Organised Crime – Most organised crime criminalities are conducted within the criminal and outlaw environment. (Noteworthy, case study four has pointed out an exception, where organised crime members executed credit card fraud against innocent members of the society.)

In addition, the family culture of individual offenders was reported on the second least in the eleven cases. Although the trial and appeal judges did refer to other sociological and social-psychological factors while convicting and sentencing offenders, it appears that the family culture in terms of male domination and unequal opportunity did not play a significant part. However, in terms of understanding and highlighting possible suspects in future cases, it could be argued that this variable might be valuable, as a very high percentage of offenders were raised in a strong patriarchal culture.

Interestingly, the study has highlighted the importance of social networks, both from the criminal and law-enforcement perspectives. From a criminal perspective, most of the groups relied heavily on in-person, mobile phones and e-mail communication strategies to plan, execute, direct and control the joint criminal enterprises. No use of social media, per se, was accentuated in the cases, suggesting that the criminal groups did not embrace these networks; they were more covert groups understanding the risk that could be introduced by these networks or the investigation authorities were unable to gather sufficient evidence. Notwithstanding this fact, the law-enforcement and prosecution have adduced in a number of cases surveillance, telephone conversation and meta-data evidence to portray the sequence of events.

> *Inference 5: The Importance of Social Networks* – When examining organised crime, it is absolutely imperative to discern, assimilate and infer the general building blocks of social networks (i.e. communication methods, group autonomy, social support and so forth). In most cases, these building blocks are visible and evident in a variety of manifestations, depending on the covertness of the group.

In summary, all of the first thirty variables have assisted in one way or another in scrutinising and understanding the eleven cases. In terms of the first research objective, this section motivated and argued that these variables, as a minimum, underpin the *critical attributes* necessary for investigating offenders and relationships of organised criminal groups and activities. Therefore, as variable 31 relates to additional information not incorporated in the first thirty variables, it is concluded that variables 1 to 30 should be included in final table of suitable variables required for examining organised crime. Please see appendix C.

6.4.2   Research Objective Two: Suitable Behavioural Theories

A wide range of variables relating to either social-psychological or sociological theories are assessed in the study. The results of this study suggest that on average 92% of the social-psychological variables assisted in understanding the intricacy of the cases, whereas on average 62% of the sociological theories engender explanation for offenders' actions. No equivalent research studies could be ascertained to compare and contrast this finding against. However, a prevalent observation is that the prosecution and reporting journalists for the eleven cases have focused more on social behaviour in terms of what offenders or alleged offenders are doing and how others influence them. Less attention is drawn on the nature and occurrence of crime by analysing the structure of the society that shaped the

behaviour of the offenders, hence the reason for the possible differentiation in reporting levels between the two sets of variables.

In terms of social-psychological theories, the data set suggests that social learning theory developed by Akers (1999) is best equipped to articulate organised crime cases. The underpinning concept of this theory states that criminal behaviour is learned in interaction with others, normally within intimate personal groups. In all of the cases, evidence could be found that highlights the exposure of negative association that led to the commitment of crime. Further to that, the data set also revealed that all offenders committed the crime for financial gain, which is in line with the definition of organised crime and assertions of Akers and others. Moreover, in all cases the offenders expected to receive sentences equal to the lower end of the punishment yardstick; this was evident in the large amount of appeal cases lodged against the sentences. Therefore, the fact that the balance between anticipated rewards and punishment was heavily in favour of rewards for all the cases, could possibly explain the behaviour of the offenders from a social-psychological perspective.

With regards to sociological theories, the feminist theory as a secondary theory best explains why offenders commit organised crime acts. The primary concept of the feminist theory is that the rights and privileges of males are more superior compared to females, and females are more disadvantaged, restricted and controlled. White & Perrone (2010) conclude by stating that a female is less likely to commit crime in general due to the disadvantages and restrictions. The results of the study supported this statement in that only 10% of the offenders were females. Following on from this result, it also highlights that most of the male offenders belonged to the powerful economic social class that own one or more properties and/or businesses. Thus, in terms of correlation of organised crime, if the feminist theory is applied as a secondary theory and findings of the case studies are representative of the population, it could be argued that males belonging to the powerful economic class of society, and who participate in either overly or covertly group associations, are more likely to participate in organised crime events.

6.4.3 Research Objective Three: Methodology of Organised Crime Offenders

Section 6.3.4 and table 6.4 outline the findings of the case study in relation to the methodology (modus operandi) followed by the offenders. The results of the case study have revealed that one or more of the five generic phases were executed by the majority of the offenders.

Klima (2012) and Kleemans et al. (2010) highlight the lack of research on modus operandi for more complex and dynamic crime, such as organised crime. They proclaim that organised crimes have a multiplicity of modus operandi, some of which remain invisible and unknown to law enforcement and researchers. Daniels et al. (2016) agree with the previous researchers and state that the methods used by criminals vary depending upon the crime. The statement was tested by searching the ProQuest database, using the search string, "modus operandi organised crime", which returned a number of research papers that focus more or less on modus operandi of offenders on a single criminal activity bases. The most

common criminal activities attended to in the research papers related to money laundering and human trafficking. No significant research project on general modus operandi, as followed by offenders for a variety of organised crime acts, could be ascertained to compare and contrast the findings against in table 6.4.

Notwithstanding the lack of research, Klima (2012) utilizes the framework of crime activities as provided by the criminologist Zedner (2007) to explain the dimensions of vulnerability to crime, i.e. organised crime, from an economic perspective. Zedner (2007) asserts that crime activities could be categorised into three discrete phases, i.e. pre-crime, criminal event and post-crime phases. Some correlation between the phases utilized by Zedner (2007) and the phases used in this research project to analyse modus operandi of organised crime offenders can be drawn. It could be argued that the planning and preparation phases link up well with the pre-crime phase, while the execution phase corresponds with the criminal event. In addition, the direction and control phases overlap with all three phases of Zedner's model.

More importantly, the findings of Daniels et al. (2016), in terms of the pilot study of criminal abductors' modus operandi, could be used as baseline to compare and contrast the findings of table 6.4. The researchers conceptualised the kidnapping criminal event by means of three phases, namely pre-event planning and preparation, event execution and post-event phases. The researchers interviewed eight offenders to understand the tactics, techniques, procedures and activities used by them to execute a captive-taking event. The study employed a qualitative research methodology and identified 35 core ideas/activities conducted by the offenders during their criminal events. These ideas/activities were then categorised into the three phases.

The pre-event phase relates to the actions conducted prior to the captive-taking event, such as weapon acquisition. This phase correlates to the planning and preparation phases of the holistic taxonomy; the results of the case study analyses for this research project highlight a number of occurrences where offenders acquired weapons. Other pre-event similar activities include, but not limited to, auxiliary support, logistical decision-making and intelligence gathering.

Furthermore, the event execution phase of Daniels et al. (2016) reflects the perpetrators' behaviour and actions during the criminal event, and it corresponds with the execution phase of the holistic taxonomy. Similar activities for this phase include execution of criminal acts, extortion to persuade victims to cooperate, and travelling methods to destinations where crimes will be committed. The major differential between the two classifications relates to the emphasis placed on prevention of possible arrestment. The findings of Daniels et al. (2016) study explicitly revealed that offenders of kidnapping focus heavily on prevention of arrestment during the execution phase, whilst the results of table 6.4 show that prevention of arrestment is normally addressed during the planning phase. One possible explanation for this disparity could relate to the group context versus individual context of the criminal act. For organised crime events, the prevention strategy is created in the early stage of the act so that all members could agree to the protection plan. For

abduction criminal acts, most offenders operate autonomously. Therefore, protection during the execution is his/her own responsibility.

Likewise, the post-event phase of abduction classification could also be linked to the execution phase of the holistic taxonomy. Daniels et al. (2016) reported that most kidnap offenders execute 'clean-up' tasks directly after the criminal act to evade the police in the medium and long-term and to prevent surrendering. An example of such activity includes the cutting of telephone wires to houses or confiscation of mobile phones.

In conclusion, the phases and activities listed in table 6.4 are based on general and typical activities conducted by offenders in the eleven case studies. Further research could possibly identify additional activities, as well as unique activities for each of the criminal event. However, due to the substantial correlation of the findings in table 6.4 for all eleven cases and the findings of Daniels et al. (2016), it could be argued that organised crime offenders are following typical actions during the execution of criminal events.

6.4.4   Limitations and Strengths of the Analysis

In terms of limitations of the study, several limitations are identified that could have an impact on the results obtained from the study. The key limitations are listed below:

Limitation 1: Small Sample Size - As this study is based on qualitative research method using a small sample that focuses on exploration of criminal independent variables, caution must be adduced to certain interpretation. Consequently, the researcher acknowledges the fact that the data garnered from the sample cannot be generalised to all criminals conducting organised crime activities. For example, the selected cases focused on five of the core organised crime activities and may be skewed in terms of all organised crime cases in Australia.

The small sample size for the study was necessitated due to the lack of suitable case materials, as was outlined in section 6.2.2. Notwithstanding this unavoidable limitation, O'Reilly & Parker (2012) have pointed out that small sample sizes for a qualitative study is acceptable for most reputable research projects, provided that the data has reached saturation during the analysis process. For this study, data saturation was achieved during the elaborative content analysis research process. Noteworthy, other research projects in the field of organised crime have also encompassed small sample sizes due to similar limitations (Kirby & Snow, 2016). Notwithstanding the small sample size, the results discovered and discussed in section 6.3 highlight the value of the research by providing significant insights into organised crime or by confirming existing facts on the phenomenon.

Limitation 2: Lack of International Organised Crime Cases Included in Study – The study has predominately focused on organised crime in Australia in order to assist both state and federal law enforcement agencies to tackle, and possibly eradicate, the perverted phenomenon. Also, case information on international organised crime activities is limited in the search database. However, in chapter 2, it was explicated that organised

crime is a world-wide phenomenon and in certain instances the crime is conducted transnationally. Therefore, to apply the findings of this study to organised crime in general, more international cases should be studied.

An international study on organised crime and international Italian mafia activities by Calderoni, Berlusconi & Garofalo (2016) was conducted in 61 countries around the world, including Australia. The results of the study have revealed similar patterns and tendencies in terms of organised crime activities in the majority of countries, viz. drug trafficking is the most frequent activity, whereas money laundering appears less important than expected (Calderoni, Berlusconi & Garofalo, 2016, pp.413-416). The empirical results attained from the study hypothesize the inference that certain aspects of transnational organised crime are reasonably similar and therefore the results from the eleven cases in this chapter could be applied in a broader sense in terms of international organised crime activities. However, the international study has also discovered that organised crime group activities could be 'highly structured' to 'fairly unregulated', depending on the motive of the group in each country. This significant fact most properly impacts the modus operandi and reporting structure in each group, to name a few. Therefore, ideally, an international collaborative research project could further explore the findings in section 6.3.

Despite the limitations, a number of strengths that underpin the research project were discerned and considered. The two main fortes are recorded below:

Strength 1: The Study Produces Constructive Results – First and foremost, the analysis yielded significant information regarding which independent variables are required to scrutinise and comprehend organised crime cases. Therefore, the case study and content analysis research methods have shown the ability to identify and evaluate independent variables, thereby confirming the critical attributes of offenders and their relationships in terms of organised crime. Further to that, the results acquired were reasonably constant for most cases, as highlighted by the significant low mean values in tables 6.1 and 6.3.

Strength 2: Secondary Supplementary Findings - In addition, the examination also produced significant information in terms of which category of variables best explains organised crime cases, as well as what general modus operandi is followed by perpetrators while conducting organised crime. Furthermore, the case study and content analysis research methods were still able to discover consistent supplementary findings, even in cases where limited information on the case of interest was available. The main reason offered for this assertion is the fact that qualitative research is well renowned for discovering facts from large quantities of data (thick data) and from finite data that is compact and intricate (rich data) (Fusch & Ness, 2015, p.1409).

Notwithstanding the above mentioned significant fortes, *future research* is still required to confirm and expand the results attained in the case study. Future research work might include detail interviews with a number of past and present convicted organised crime

perpetrators to discuss or confirm the relevance and importance of the final thirty variables, focus group sessions that consist of both organised crime researchers and law enforcement officers to ascertain deeper knowledge on common criminal activities and modus operandi of offenders related to the variables, and so forth.

In summary, the listed findings in this chapter provide a solid platform to investigate organised crime in more depth, as well as possibly adapting existing strategies and models, or articulating new strategies and models to prevent such criminal acts from occurring in the future.

6.5   Conclusion

The meaningful research and comprehension of organised crime are extremely complex, partially due to the use of advanced technology and cohesiveness of the groups, and to some extent due to the lack of availability of quality data describing these cases. In order to address these difficulties, the primary aim of this project is to identify suitable variables that can be applied to better understand and investigate organised crime cases. Initial content analyses on eleven substantive organised crime cases were conducted to verify suitability and useability of the original list of variables identified in preceded chapters and to add additional variables, which are required to further explain the content of each case. Based on the results attained through the content analyses, the data suggests that the final thirty variables are suitable and able to illuminate the important aspects of most organised crime cases.

The suitability and useability of the two mainstream behavioural theories were also considered as part of the content analyses. The results suggest that social-psychological theories are ostensibly more suited to articulate the behaviour of organised crime offenders, compared to sociological theories. A possible reason for this observation might be that the prosecution, trial and appeal judges, and reporters focus more on the social behaviour of the offenders as it can be more easily observed and measured. To the contrary, sociological theories aim to understand the nature and occurrence of crime by analysing the structure of the society within the organised crime group. As such, many of the studied cases explicitly highlight the cohesiveness of the groups and the difficulty for law-enforcement agencies to obtain evidence against the alleged offenders, thereby prohibiting the study of the structure of organised crime groups. Nonetheless, both streams of theories have highlighted important aspects of the cases and the judges considered a number of the variables as part of the sentencing process.

The final research objective considered in this chapter, i.e. the methodology followed by organised crime gangs or syndicates, was also articulated. It was concluded that most organised crime offenders do follow the general phases as outlined in the holistic taxonomy in chapter 2. A number of general and typical actions and methods were unearthed in the case study research and were then evaluated against modus operandi of other crime activities. As this research project is introducing the holistic taxonomy and general crime phases concepts, the extent to which these

phases could illuminate new knowledge about future cases, might be questioned. Therefore, more research could be done to refine the list of possible actions and methods pertaining to each phase. Notwithstanding the current broad definitions of each phase, the obtained data suggests that by categorising the various events and actions into different phases could at least assist in determining the principal members of each group, as well as suggesting suitable sentencing for each member.

It must further be stressed that the findings of the content analyses on the eleven cases must be considered statistically inappropriate to represent all organised crime cases in Australia. Further studies on more cases should be conducted to verify the findings of the case study and content analysis research. Despite the small sample size, such findings do create an opportunity to develop effective investigation tools to portray the cases in a more understandable manner and to examine the cases by assessing certain core aspects of the case in more detail. The next chapter is focusing on an exploratory model that can operationalize the variables for further investigation.

Chapter 7

Organised Crime Reconnaissance Model (OCRM)

Organised Crime Reconnaissance Model (OCRM)

This chapter focuses on:

- Articulating the design science research methodology to be used for developing the exploratory model;
- Describing the functionality of the model;
- Presenting the architecture of the model; and
- Discussing the implementation strategy to operationalize the model.

7.1   Introduction

The foregoing chapter predominantly focused on addressing research issue I, i.e. insufficient data, information and knowledge to investigate, control and counteract organised crime. The issue was addressed by utilizing a qualitative research method, together with thirty-one independent variables, to unearth and extrapolate data, information and knowledge from eleven substantive court cases. Having successfully applied the variables and reemphasized existing knowledge while discovering additional knowledge, the attention is now moving towards developing a model that could operationalize the variables and knowledge base, thereby addressing research issue II.

As highlighted in chapter 5, the design science research methodology has been adopted to address research issue II - *The absence of a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently*. Design science research is a sound emerging discipline and has a solid theoretical and practical foundation to solve research issue II, as it is fundamentally a problem-solving paradigm that has its roots in engineering and the science of artificial intelligence (Hevner et al., 2004, p.76). As underlined by Dresch et al. (2015), design science has the reputation for seeking solutions through a pragmatic approach by developing a utility that first of all resolve the problem, and secondly highlighting important aspects of the problem in order to improve knowledge, making it extremely valuable and applicable for research issue II.

The purpose of this chapter is to explicate a new model aimed at assisting with the development of a future conceptual framework for organised crime; it is envisaged that both the model and framework could be used by both researchers and law enforcement to better understand the intricacy of organised crime cases. (The development of the conceptual framework is outside the scope of this chapter and thesis.) Further to that, the aim is also to delineate a possible

implementation strategy to operationalize the model in order for it to be useful to researchers and law enforcement officers to unpack facts from substantial organised crime cases.

The chapter commences with a discussion on design science in general and in particular on the design science research process (DSRP). This is followed by an articulation of the functionality of the proposed model, together with a discussion on the architecture of the model. Thereafter, the major components of the model and application strategy for implementing the proposed model is next described. The chapter then concludes with a short summary.

7.2 Design Science

The concept of design science was originally announced by Herbert Simon in 1969 in a book entitled, "*The Science of the Artificial*" (Dresch et al., 2015, p.1119). Simon explicitly accentuates the differences between traditional science and design science in that the former aims to explore, describe and explain truth, whilst the latter mainly focuses on delivering artifacts or solutions. Romme (2003) and Van Aken (2007) are in accordance with Simon by stating that design science provides a paradigm that deals with the design of new systems or solutions of real and relevant problems. Piiranen and Briggs (2011) elaborate further by stating that design science is applied to improve the transparency and rigor of the design and development of new systems or solutions. Moreover, Patas, Milicevic and Goeken (2011) suggest that design science is in particular well suited for researching behavioural aspects, which makes design science highly suitable for research issue II.

Hevner et al. (2004) concur with the description of above authors and elaborate further by asserting that design science is inherently concerned about problem-solving and they provide a comprehensive process that derived knowledge and understanding of a problem and its solution through building and applying an artifact. March and Smith (1995) proclaim that artifacts delivered by the design science process can be categorised as constructs, models, methods and instantiations. In this context, Hevner et al. (2004) describe the purpose of constructs as to provide the language or sematic in which the problem and solution can be defined and communicated. Furthermore, they claim that models utilize constructs to represent a real-world situation, i.e. the design problem and its solution realm. In design science, the model artifact provides a platform to researchers to develop and present solution components that enable exploration of the effects of design objectives in the real-world. Methods, on the other hand, define processes that guide the researcher on how to solve the design problem. Methods can range from formal mathematical algorithms to 'best practice' approaches. Finally, instantiations are concerned with how constructs, models or methods can be implemented in a real-world situation. The main purpose of the instantiation artifact is to demonstrate feasibility of constructs, models and methods and to make a determination whether they are able to address the research problem.

Based on the description of Hevner et al. (2004) and March & Smith (1995), the problem of concern for this chapter relates to the absence of a universal overarching framework to investigate and comprehend organised crime activities; the selected artifact to address this problem is a general

model. The major reason for embarking on the development of a general model is due to the fact that only clarification models exist currently. In chapter 2, three clarification models for organised crime have been articulated, i.e. the Contingency model, Costa Nostra model and Enterprise model. However, as highlighted by Morrison (2002), in most cases these models mainly analyse the nature and extent of organised crime by focusing on the structure of the outlaw organisation with finite explication of the interrelated aspects of organised crime, such as processes, environments and implications of illegal activities. For this reason, a new general exploratory model is proposed that builds on knowledge from existing clarification models, as well as incorporating processes and environmental aspects, to further explore modern organised crime events. The ultimate aim is to instantiate the proposed general model on various scenarios and substantive cases, either through initial testing by means of this thesis or future research projects, in order to gather enough and profound knowledge to develop a contemporary overarching framework.

The application of design science to cultivate general models by means of an empirical design methodology is in general conducted through methodical process-driven activities (Peffers et al., 2006, p.89). The most common design methodologies are: The Design Cycle (DC) method of Vaishnavi & Kuechler (2004), Action Design Research (ADR) method of Sein et al. (2012) and the Design Science Research Process (DSRP) method of Peffers et al. (2008).

Although all of the above mentioned methodologies have many similarities between them, it was decided to adopt the DSRP method due to the smaller incremental steps of design and the multi-entry points into the research design.

The DSPR method comprises six stages, namely:

- Problem identification and motivation;
- Objectives of a solution;
- Design and development;
- Demonstration;
- Evaluation; and
- Communication.

Each of these steps has been articulated in section 5.4.2, with the focus on developing a general theoretical model and prototype that could assist with the unpacking and comprehension of organised crime activities more effectively and efficiently. As the problem statement and objectives of this research project were explicitly defined in chapter 5, based on an extensive literature review, the first two stages of the process have already been addressed; the focus of this chapter is now shifting towards stage three of the DSPR method – Design and development.

Peffers et al. (2006) further proclaim that this stage, i.e. the design and development stage, is the nexus of the design science methodology. The main reason offered is that the knowledge of theories pertaining to the research problem should be brought together to provide a conceptual understanding of the problem and to bear a solution; for this research project the solution is a general exploratory model. The literature review chapters (chapters 2, 3 and 4) focus on a number of clarification models, organised crime taxonomies, general crime variables, crime related behavioural theories and social network variables. The knowledge obtained through these chapters

is now being integrated into a blueprint for the new general model. As outlined by Peffers et al. (2006), the blueprint is constructed by defining the desired functionalities of the model, followed by the delineating of the architecture. Each of these activities is articulated in more detail in the next two sections.

An overview of the design science research process paradigm executed for this research project is depicted in Figure 7.1. The figure shows a three-tier process exerted to design and derives the new general model, as well as evaluating the value and relevance of the model. During stage one, the research problem and research objectives as outlined in chapter 5, the main concepts of organised crime and criminal behaviour as defined in chapters 2 and 3, as well as the finds of the case study analyses in chapter 6, are all combined to confirm or extend the various criminal theories in an organised crime domain and to enlist the final list of independent variables. In stage two, the main functionalities and architecture of the model are developed to operationalize the independent variables. During stage three, a prototype of the model is developed and evaluated, resulting in constructive suggestions to enhance the model further.
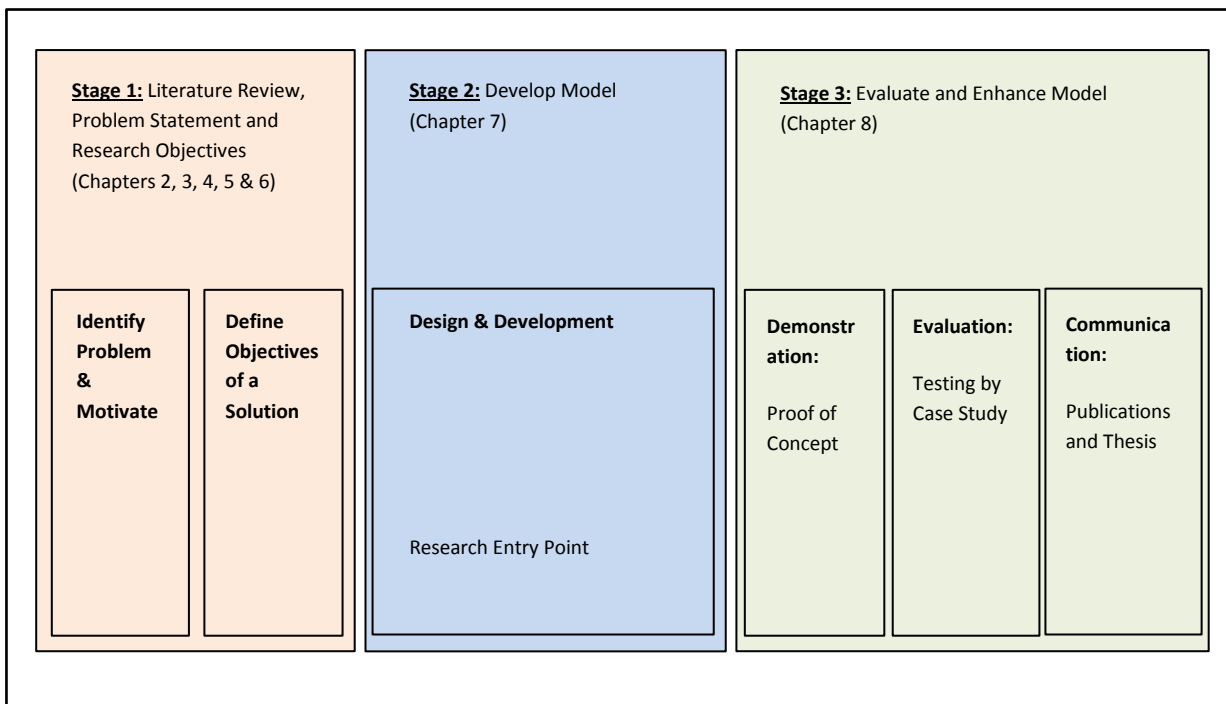
Figure 7.1 Applied Design Science Process Paradigm for Research Issue II [Adopted from: (Peffers et al., 2008)].

The next section is now focusing on stage two and more in particular on delineating the functionalities of the new exploratory model.

7.3   Design Specification: Functionality of the Model

As concluded in the previous section, this section is now focusing on the required functionalities of the proposed model. Functionality in this context refers to a range of operations that can either be executed automatically on a computer or performed manually by a researcher or law enforcement officer in order to examine an organised crime case.

In chapter 2, it was outlined that a new model is urgently required to unravel the complicated phenomenon in a meaningful and meticulous manner, and in a timely fashion. Thus, the functionalities of any proposed model should enable both researchers and law enforcement officers to investigate and scrutinise organised crime cases, either in real-time or historically. In terms of functionalities required by researchers, White and Perrone (2010) highlight a number of tasks that should be completed by researchers when embarking on criminological research, which should be catered for by any new crime related model that has the aim to support researchers. These include, among other things:

- Analyse general documents, such as files, agency reports, maps, correspondence, budgets;
- Analyse media contents, such as cartoons, newspaper editorials, articles and letters, films and radio transcripts;
- Analysis of official statistics, such as Australian Institute of Criminology, Australian Bureau of Statistics, New South Wales Bureau of Crime statistic, Western Australia Crime Statistic, and so forth;
- Comparing crime statistics across different jurisdictions;
- Incorporate survey information as part of an investigation, such as questionnaires, telephone surveys, suggestion boxes and so forth;
- Compute broad statistical trends, including number of people that committing a certain crime, the extent of crime in particular geographical area, rate of crime expressed in relation to time, and trends in crime by highlighting broad changes in crime rate over certain time periods;
- Highlighting the human behaviour perspective in each case; and
- Computing the effect of intervention programs, such as treatment program, strategy or project on a target group.

With relation to systems used by law enforcement to investigate crime, Gupta & Chandra (2013) assert that many criminal investigation agencies use intelligent support systems to investigate crime and to detect criminal acts. These systems, in general, encompass large numbers of information and huge volumes of records pertaining to crime and criminals, as well as an intelligent analytical algorithm to analyse the records. In some cases, these systems attempt to do criminal profiling: criminal profiling is a process to identify demographic variables, geographical location and behavioural patterns of a perpetrator based on characteristics of previous criminals who have committed comparable offences (White and Perrone, 2010, p.339). In terms of criminal profiling, White and Perrone (2010) and Bartol and Bartol (2014) highlight a number of features which should be investigated by law enforcement officers when assessing criminal events and should ideally be incorporated in a model, namely:

- Identify certain actions or procedures of offenders that enable them to commit the crime successfully (Also known as Modus Operandi);
- Identify behavioural aspect of offenders; and
- Identify motive/s of offenders.

Another ubiquitous method used by law enforcement officers to investigate crime is crime mapping (Leong & Chan, 2014, p.422). Santos (2016) defines crime mapping as the process of conducting spatial analysis as part of studying criminal events. Crime mapping is a mature process and can be dated back to the year 1829 where investigators created a map that exhibits the relationship between violent and property crimes, and educational levels in France (Chamard, 2006). Today, crime mapping is usually operationalized by means of a contemporary Web-based crime mapping software package and it provides crime intelligence to both the public as well as law enforcement. In general, Web-based crime mapping software is used to highlight high-level crime information to the public, i.e. crime hotspots, whereas law-enforcers exerted it to support internal crime prevention decision-making (Leong & Chan, 2014, p.422).

Leong & Chan (2014) studied 48 Web-based crime mapping software packages to identify the most important functionalities from the perspective of both the public and law-enforcers to comprehend crime activities. The functionalities are, but not limited to:

- Identify the crime location/s;
- Identify the crime distribution patterns;
- Identify the areas with high concentrations of crime;
- Identify and display crime pattern changes over time;
- Creating crime maps per predefined locations;
- Creating crime maps per predefined crime types; and
- Creating crime maps per predefined time ranges.

Based on the functionalities listed above and the implementation of the holistic taxonomy of organised crime and independent variables, it is recommended that the proposed model should enable the execution of the following functionalities:

- Reading and analysing of general documents;
- Reading and analysing of media contents;
- Accessing and analysing of social media contents;
- Computing general crime variables to explicate demographical crime information;
- Identifying the core members of the organised crime organisation;
- Identifying crime locations, crime types and time span for crime activities;
- Identifying the organised crime structure;
- Computing the motive for committing the crime;
- Identifying the tools used in committing the crime;
- Computing behavioural aspects of the offenders;
- Mapping the actions of offenders to the generic phases of the holistic taxonomy;
- Computing and displaying crime evolution over a period of time;
- Creating and displaying crime maps per location and predefined time periods; and

- Proposing counter action if the case is analysed in real-time.

In this section, the functionalities of the new proposed model were articulated based on requirements from crime researchers and functionalities of existing crime analysing software packages. The end result was the enlisting of fourteen functionalities that are earmarked for incorporation in the new proposed model. Following on from these functionalities, the next section is now describing the proposed architecture for the new model.

7.4   The Architecture

The preceded section outlines a number of functionalities for the new proposed model. These functionalities range from simple read activities to more advanced computational actions; the diverse range of functions emphasizing the requirement for a well-defined architecture. This section aims to delineate the architecture based on the listed functionalities. The term architecture for this chapter refers to system building blocks of the proposed model that is necessary to process the outlined functionalities in order to investigate organised crime cases.

The new proposed model is grounded on a hierarchical structure and can best be articulated by using the system methodology. The system methodology comprises three layers, i.e. an input layer, processing layer and output layer. Figure 7.2 depicts the hierarchical structure for the proposed model in terms of the three layers. Each of the layers of the proposed model is briefly articulated below.

- Input Layer

    The input layer is mainly responsible for acquiring input data from a variety of sources and to convert and store the data in suitable databases. Acquisition of data could be executed in real-time or in batches, either by users or through automation. Sources such as social media, news media and general crime related documents constitute the core basis for providing input data. For example, information from Facebook user profiles could be obtained and stored in the social media database, while historical news articles relating to previous cases or alleged offenders could also be acquired and stored in the media database. Further to that, relevant court summary and other documents could be stored in a general document database.

- Processing Layer

    The processing layer processes the acquired input data by mapping the actions and events to the holistic taxonomy of organised crime and computing crime evolution over a period of time. Mapping of actions and events are primarily conducted by populating the independent variables, as defined in chapter 3. The computation of the crime evolution over time is conducted by implementing network science as delineated in chapter 4. The core activity in analysing the crime event is to apply the five steps exploratory approach, as

defined in section 4.5. The results of the mapping and computation processes are then stored in the knowledge database and forwarded to the output layer in real-time.

- Output Layer

The output layer visualises the results computed by the processing components, as well as presenting an open interface for exchanging data with legacy or contemporary crime systems. The aim of this layer is to support exploration and decision-making by communicating the results of crime network measurements and/or by visually compare the structure and dynamics of crime networks. Visualisation techniques provisioned range from well-designed tables (matrixes) that support easy comparison, layouts of crime networks (structure of networks), to visualisation of organised crime group/syndicate dynamics.
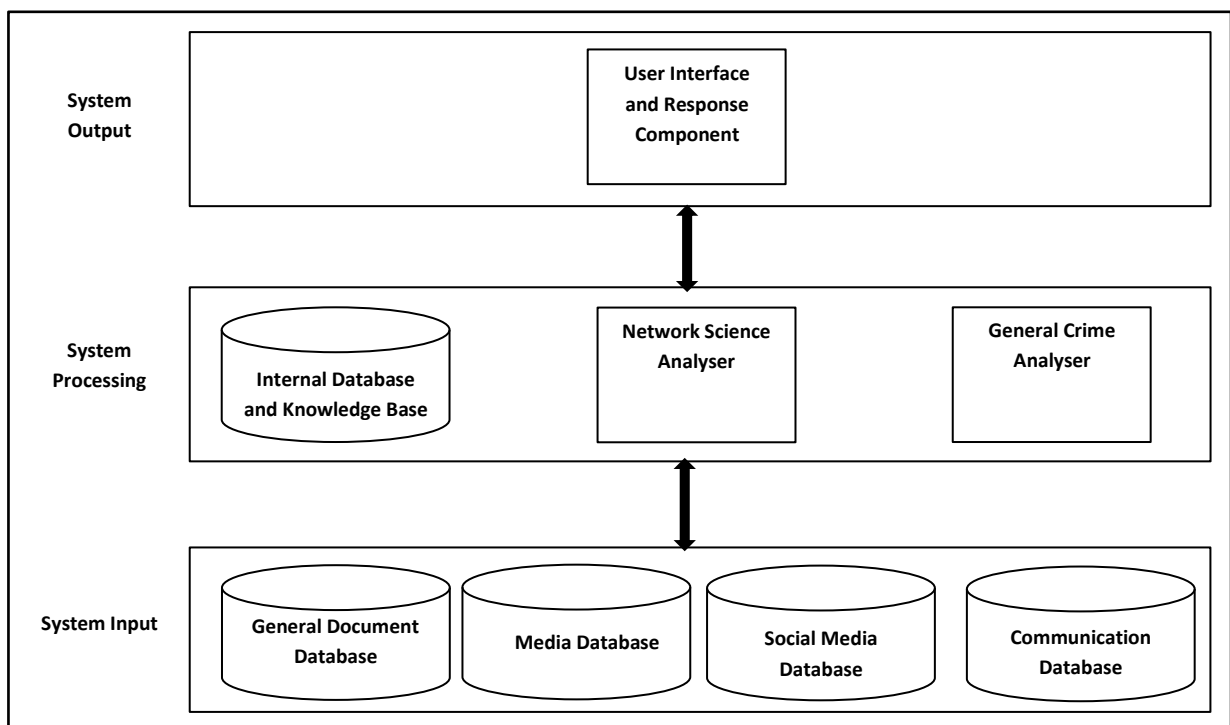
Figure 7.2 Architecture of Proposed General Model.

The architecture of the proposed model was briefly introduced above. The architecture comprises a number of data input sources, processing units, and user interface and response units; all of which are required to operationalize the listed functionalities in the previous section. Next, the system building blocks and functionalities are mapped to create conceptual components that could address research issue II, as highlighted in the introduction.

7.5   The Conceptual Model: Organised Crime Reconnaissance Model (OCRM)

Having introduced the design specifications and architecture for the proposed model previously as per the design science research process (DSRP) method of Peffers et al. (2008), it is now possible to propose the new general exploratory model which could allow researchers and law enforcers to unpack organised crime acts systematically. The model is called the Organised Crime Reconnaissance Model (OCRM). Figure 7.3 depicts the three major components of OCRM, i.e. acquisition components, internal organised crime analysis engine and responding components. Each major component encompasses a number of sub components, which are also discussed in more detail in the section below.

| Acquisition Components | Internal Organised Crime Analysis Engine | Responding Components |
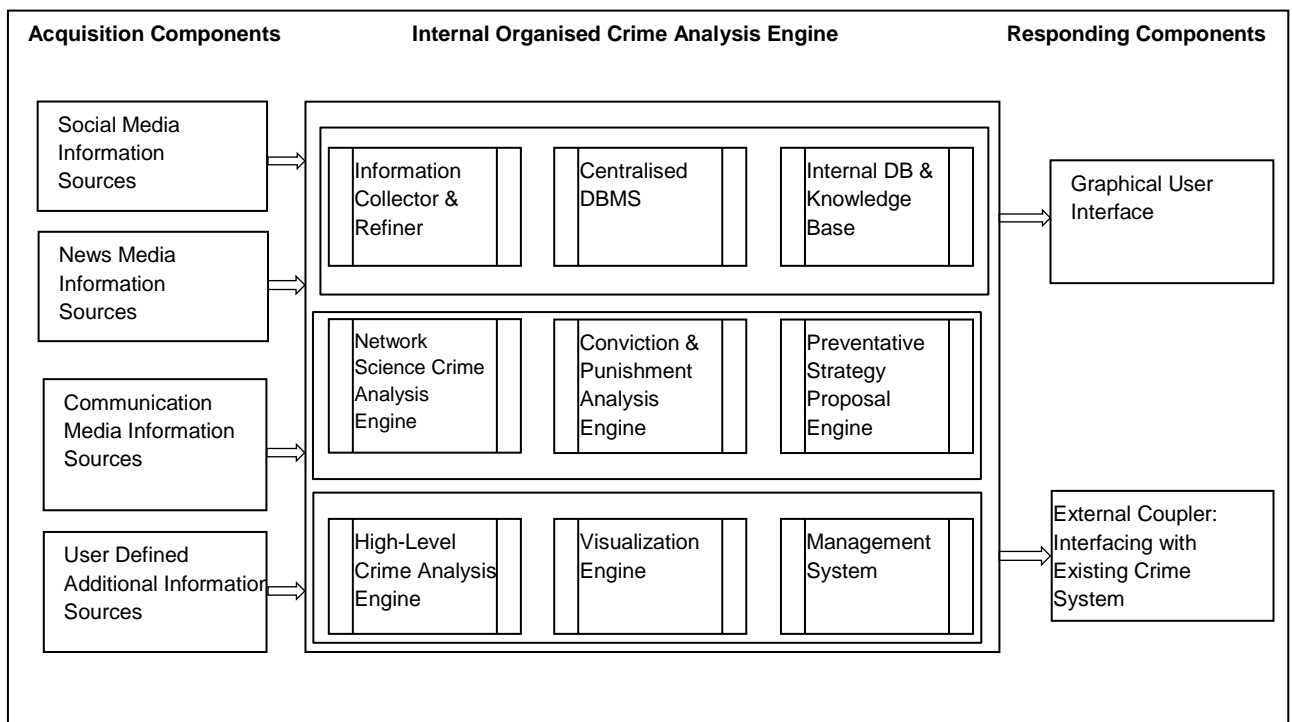
Figure 7.3: The General Representation of OCRM.

Each of the sub-components of OCRM is articulated briefly below:

- Information Sources

  The information sources refer to the various sources that could provide background information to the researcher and law enforcement officer. While conducting the case study analyses in the previous chapter, four main information sources were accentuated. These sources include: Social Media Information Sources, News Media Information Sources, Communication Media Information Sources and User Defined Additional Information. Social Media Information Sources pertain to all the information that could be gathered from social media, such as Facebook, Twitter, Instagram and so forth. News Media Information Sources relate to news and internet articles applicable to the case; the case study conducted on the eleven substantive organised crime cases have emphasized myriad articles available on the internet that could extrapolate important aspects of crime

cases. The Communication Media Information Sources include both actual voice conversations and meta-data of telephone calls, as well as e-mail conversations for all members of the organised crime group. The User Defined Additional Information Sources refer to any other sources that could assist in inferring the case in more detail, such as video surveillance footages, court summary documents of previous cases, and applicable criminal act and legislation documentation.

- Information Collector & Refiner

The information collector and refiner component is responsible for collecting the relevant data from the four key information sources, subsequently structuring it to the appropriate format and storing the formatted data in the internal database. The collection of relevant data can be conducted by either executing context analysis or theme analysis on each data set manually or per software script or by completing a questionnaire, as similarly used for the case study analyses in chapter 6. Notwithstanding the method of collection, the collected data in terms of the independent variables is then formatted by using SQL statements and sorted in chronological order. Grouping of the sorted data is accomplished by date stamping and time referencing the data, preferably by using Network Time Protocol referencing, where possible. Finally, the formatted and sorted data is stored in the internal database by means of the centralised database management system.

- Centralised Database Management System

The centralised database management system (DBMS) is a computer software application internal to the model that interacts with administrators, investigators, other internal components, and the centralised database itself to capture and display data. The DBMS is based on a two-tier architecture where the Graphical User Interface (GUI) module is used to access the DBMS. Moreover, the DBMS resides on the server platform, whilst the GUI module could exist on either the server or client platform.

- Internal Database & Knowledge Base

The internal database stores formatted data received from the information sources via the information collector along with management system data. The knowledge base, on the other hand, resides within the internal database and stores the refined data applicable to each independent variable, as well as any inferences concluded by the relevant analysis and proposal engines. Furthermore, the knowledge base also saves summarisation results and information regarding various network matrixes and measurements.

- Network Science Crime Analysis Engine

This engine processes the formatted data by applying network science through the five steps exploratory approach. Based on the approach, the engine commences by constructing and computing a high-level layout or network structure, grounded on the independent variables, in order to exhibit the organisation under investigation. Next, it computes the node, local and global network measures of the organised crime group. The

aim is to determine the size of the organised crime network, overall cohesiveness of the group, members with influence in the group and overall power of each member in the group.

After computing the network measures, the engine compares and contrasts each of the measures in order to identify possible cliques, boundary spanners, hubs, authorities, adopters, diffusors, influential individuals and opinion leaders in the group. This is followed by segregating the overall network into smaller networks by removing the hubs and/or authorities from the network. The engine then compares and contrasts the smaller networks and highlights the respective skill level, level of control and relationships within the smaller groups.

Finally, the engine computes the synchronized evolution of the network (as the network developed over time) by means of identifying the dynamics of core nodes and relationships, emergent leaders, types of crime or delinquency offences, movement of nodes, and workload of individuals and overall organisation.

All network structural diagrams, matrixes and measures delivered by the network science crime analysis engine are then used to make further general augmenting inferences, such as modus operandi (actions and procedures of offenders), behavioural aspects and so forth.

- Conviction and Punishment Analysis Engine

The main aim of this engine is to highlight the involvement of each member in the group in relation to the maximum penalty prescribed in the relevant criminal code. The conviction and punishment analysis engine studies various network measures and then computes the recommended conviction outcome and appropriate punishment/penalties based on the level of involvement by each alleged offender. Importantly, as highlighted in section 2.5, conviction and sentencing are conducted with a level of discretion and are therefore extremely onerous to predict accurately. However, for this model network science is used to compute the level of involvement according to the network structure that represents the organised crime organisation. In the case of computing the proposed conviction verdict, the engine calculates the various communities within the crime organisation. All members who are part of the crime execution community and who have bi-directional links to and from other members in the network, are deemed to collude together to conspire an organised crime activity. Hence, the engine will recommend that these members are found guilty/convicted for the alleged crime.

In terms of the sentencing (recommended punishment), the engine will apply the 'social justice' concept, as discussed in chapter 2. In summary, the engine computes the overall level of involvement of each alleged offender in relation to other members, the level of influence by each alleged offender within the group, any plea-bargaining agreements, and good character and assistance to authority alleviation factors. Each applicable measure is normalised to 1 and equally weighted and added together, after which the engine will multiply the total value with the level of remorse shown by each offender. The final value

is ranging between 50 and 100 per cent. The researcher or law enforcement officer can then multiply the final value with the maximum penalty prescribed by the appropriate criminal code. Important to note that all mitigation factors subtracted from the maximum penalty should not exceed 50 per cent. Thus, the minimum penalty proposed for offenders should always be equal or exceeding 50 per cent of maximum penalty. Both the proposed conviction and punishment verdict for each member are stored in the internal database.

- Preventative Strategy Proposal Engine

The purpose of this engine is to allow the researcher or law enforcement officer to develop counteractive or preventative strategies. The organised crime preventive strategies supported by the engine are based on the situational crime prevention strategy, as outlined by White and Perrone (2010). This strategy is offence-focussed and designed to reduce the opportunities for committing the crime insofar as increasing the effort to commit crime, increase the risks, reducing the rewards and inducing guilt or shame.

The engine implements the key concepts of the situational crime prevention strategy by eliminating important members from the organised crime group or by highlighting possible future activities, thereby increasing the effort to commit crime and increasing the risk for the offenders. For this reason, the engine identifies important members of the group; thereafter, it calculates a network structure based on the proposed removal of offenders and finally compares it against the original network structure. Important aspects that ought to be highlighted are as follows:

- Who are the prominent members with authority in the group – original and modified structure;
- The network topology – original and modified structure;
- Which of the remaining members are now high in closeness;
- Which of the left-over members are now high in betweenness;
- Which of the residual members are high in eigenvector;
- Which of the remaining members is now the emergent leader;
- Which of the residual members is now the information hub;
- Which of the remaining members is now the information authority;
- Which of the residual members have now the highest level of group knowledge;
- Which of the remaining members have now the highest workload; and
- Are there any left-over members who have a cluster co-efficient of 0.5 or more?

Furthermore, the engine also highlights the most suitable members of the group to be targeted for implementing the disinformation campaign. Misleading information relating to the effort to commit the organised crime activity, the risk associated with the crime and reduction of rewards is fed to the group by the boundary spanner/s and opinion leader/s. As a result, the group could possibly be destabilised and the impact of the criminal activity could be minimised or prevented.

- High-Level Crime Analysis Engine

The high-level crime analysis engine is responsible to generate an overall crime report, which will include, among others, the following:

o   Key people involved in the case (offenders, victims, witnesses, and so forth);
o   Overall network statistics;
o   Possible offences;
o   Possible threats based on offences;
o   Likelihood of occurrence of threats;
o   Possible impact if threats are to occur;
o   Conviction probability;
o   Possible penalties;
o   Network structures; and
o   Matrixes.

The engine will forward the report to the client's GUI, as well as storing it in the internal database for future investigation.

- Visualization Engine

The visualization engine is mainly concerned with the communication and summarisation of results and information regarding various network matrixes and measurements, as well as the exhibition of visual similarities and differences of network structures and dynamics of networks. The aim of the engine is to adduce results and information that enable investigators to effectively assess, explore and comprehend complex networks. As such, the engine presents the results of the network measurements in matrixes/tables, tree layouts, graphical layouts and network dynamic layouts formats.

The engine generates N x N matrixes/tables that allow the investigator to quickly identify the nature of the linkage amongst all members of the organised crime group, whereas the tree layouts illuminate the hierarchical relationships in order to identify, among others, leaders and emergent leaders in the group. Further on, it also produces graphical layouts to enable for analyses of the structure of networks, especially to identify common patterns, such as cliques, clusters and communities. Finally, the visualization engine engenders network dynamic layouts to assists with the understanding of activities or processes that are followed by each member of the group.

- Management System

The management system allows researchers and investigators to set up components and overall settings related to the internal organised crime analysis engine. The system is predominantly responsible for configuration and security services management and the main functions are described below:

o   Configuration Management

Configuration management includes, among others, the set up of the information collector and refiner, centralised DBMS, independent variables, alternative sentencing

principles, alternative crime prevention strategies, alternative crime reports and alternative visual layouts. Further to that, it empowers administrators to construct user profiles pertaining to the graphical user interface and establish system-level interfacing with external crime systems.

o Security Management

Security services management encompasses the setting up and management of security services applicable to OCRM. Some of the services include controlling user credentials, confidentiality, integrity and access control services.

- Graphical User Interface

The GUI component provides a user-friendly adaptive and intuitive interfacing between administrators/investigators and the OCRM model. Administrators utilize this interface to access the management system to setup and manage the model, whereas the investigators use the interface to construct case studies and investigation cases. The GUI also provides the investigator with a fast method to optimise the overall crime report by directly accessing the high-level crime analysis engine and selecting reporting options from a standard predefined option list.

- External Coupler: Interfacing with Existing Crime System

The external coupler component is an interface unit that provides an Application Programming Interface (API) for network communication between the OCRM model and other external crime systems. The core function of this component is to maintain a consistent, reliable and secure exchange of data between the model and external systems. This is achieved by implementing a suite of software modules by means of an application virtual machine, such as .NET Framework and .NET Core.

The fifteen sub-components that constitute the OCRM model have been articulated. The components are defined, based on the preceded architecture as acquisition, analysis engines and responding components. Importantly, the logical organisation and operation of components and sub-components enable researchers and law enforcement officers to effectively study substantive organised cases by following a systematic and meticulous process. The implementation process of these components and sub-components is described next.

7.6 Implementation of OCRM

The general exploratory model, called Organised Crime Reconnaissance Model (OCRM), and its fifteen sub-components, were introduced in the foregoing section. As one of the major aims of this research project is to develop a universal overarching framework/model to investigate and comprehend organised crime activities more effectively and efficiently, this section is now focussing on an implementing strategy which could enable researchers and investigators to operationalize the

model manually, semi-automatically or fully-automatically. However, in all three instances the same strategy is recommended.

The recommended strategy is defined below:

- Case Initialisation
  - Create a new case by defining unique name for the case.
  - Select the various information sources pertaining to the case.
  - Select boundaries for the case, i.e. time period, country, area, and so forth.
  - Select applicable data analysis method (content analysis or thematic analysis).
  - Select investigation level – Holistic analysis (all data sources at once) or Individual analysis (per source basis).
- Information Gathering
  - Execute the data analysis method.
  - Identify independent variables in source data.
  - Complete predefined questionnaire pertaining to independent variables.
  - Identify chronology of events.
- Capturing Data for Independent Variables
  - Store independent variable information into database.
  - Store other relevant miscellaneous information in database.
- Applying the Five Steps Exploratory Approach
  - Exhibit node and link behaviour for the case by constructing applicable matrixes.
  - Compute node/edge, local and global network measures.
  - Compare and contrast network measures.
  - Segregate case population into smaller connected communities.
  - Establish the synchronisation evolution of the network.
  - Note: All five steps can either be performed manually or by the Network Science Crime Analysis engine.
- Determining possible Conviction Outcomes and Sentences for Criminal Activities
  - Select all communities which obtained direct relationship with alleged offenders.
  - Select all members who have bi-directional relationships with other members of crime communities.
  - Tag these members in database as proposed convicted members.
  - All of these members who acquired direct relationships with the actual crime activity are tagged as 1 for involvement.
  - Recall plea bargaining agreement for each of those members. If guilty plea is recorded then assign a value of 0.75, else assign a value of 1 for each member.
  - Recall other mitigation factors for each member. If mitigation factors do exist then assign a value of 0.75, else assign a value of 1 for each member.
  - Compute the emergent leaders, hubs and authorities measures for the network.
  - Compute the various cliques within the selected communities.
  - Based on the emergent leader, hub, authority and clique measures, categorise the importance of each clique against the member as 1 for management clique, 0.5 for worker's (soldier) clique and 0.1 for protector's clique.

- Recall the remorse variable value for each alleged offender. If remorse is shown by alleged offender, then allocate a value of 0.75, else allocate a value of 1.
- Insert the maximum penalties for crime/offence.
- Compute penalties for each member by means of an appropriate formula.
- Note: Recommended sentence should be equal or more than 50% of maximum penalty. Also, above methodology can either be performed manually or by the Conviction & Punishment Analysis engine.

- Articulating possible Preventative Strategies
  - Recall the node/edge, local and global network measures.
  - Recall the hubs and authorities for the network.
  - Remove one or more hub/authority members from network and re-compute node/edge, local and global network measures.
  - Compare and contrast network measures, matrixes and layouts by outlining similarities and differences between before and after measurements, matrixes and layouts.
  - Apply the k-plex quasi-clique detection measure to search for possible members who were evicted from management over time. As a default, members who have a 50% relationship with management (thus, relationship affiliation value = 50%) or more are earmarked for possible entering/targeting members. (Investigators can set relationship affiliation value on a case-by-case basis.)
  - Compute the cutting point/boundary spanner members for the network structure under consideration.
  - Store both evicted and cutting point members as entering/targeting members for possible destabilisation strategy.
  - Recall the synchronised evolution layouts of the network and identify possible trends that could highlight future activities.
  - Note: Above methodology can either be performed manually or by the Preventative Strategy Proposal engine.

- Reporting Results
  - User selects appropriate content for report (results, matrixes and layouts).
  - Search for network measures from database either manually or via High-Level Crime Analysis engine (automated SOL statements).
  - Request appropriate network structure layouts and matrixes from visualization engine and incorporate them into report. (For manual compilation, user could consider Microsoft Excel, else utilize dedicated network science software package, such as ORA and UCINET in which the user can select reports and layouts.)

- Assimilating and Inferring Results
  - Summarise the case in terms of the holistic taxonomy of organised crime.
  - Draw theoretical conclusions by applying structural equivalent technique.
    - ➢ List number of nodes/members, edges/relationships, diameter for network to understand the size and complexity of the organised crime group.
    - ➢ Classify the structure of the network as regular lattice, small-world, random or scale-free based on the graph entropy measures, in order to categorise organised

crime organisation as structured, semi-structured or random/unstructured organisation.

➢ List clustering coefficient for each member in the organisation to determine the degree to which neighbour members are connected to each other. (A high value would indicate that neighbour members are also friends with each other, therefore indicating cohesive organisation.)

➢ List average clustering coefficient to understand whether or not the organisation has a modular or hierarchical structure.

➢ List average degree centrality measure to compute the overall density of the organisation. (Measure suggests the opportunity that exists to directly influence the organisation, i.e. member in organisation.)

➢ List closeness centrality measure to determine the communication effectiveness of the organisation. (Measure suggests the opportunity that exists to indirectly influence the organisation, i.e. external member to organisation.)

➢ List the appropriate members for each hub, authority and clique clusters. For each member, calculate the eigenvector centrality measure to comprehend the extent of relationships between each member and other influential members.

➢ List the boundary spanner/cutting point members in the organisation based on their relationship with other clusters in the organisation in order to determine the innovators in the organisation.

➢ List the path length to hub nodes/members to assimilate the likelihood of spreading information in the organisation.

➢ Remove the five most highly-connected nodes and construct new network structure layout to understand the impact of the removal. The removal could result in disrupting or disintegrating the entire network as in the case of regular lattice and scale-free topologies.

➢ Find nodes/members with similar structural properties, such as degree, clustering coefficient and betweenness to assist with the further classification of the network.

The eight steps implementation strategy for OCRM forms the core of this research project as it brings together the key research concepts, such as the holistic taxonomy of organised crime, independent variables related to organised crime and network science exploratory approach; thereby establishing a framework in which the model can be executed to address research issue II. It must be emphasized that this strategy is dynamic as it permits a diverse range of implementation methods by allowing all steps or certain steps to be automated by a software package, or one or more steps to be conducted manually. In addition, it's worthwhile noting that step five, i.e. determining possible conviction outcome and penalties, is not mandatory to be completed by the researcher or investigator as the determination is indicative only. Many other external tendencies and circumstances could influence the judgement and punishment. However, the result of this step could illuminate the severity of criminal activities for each alleged offender or assist with the comparison of various related organised crime cases.

7.7   Conclusion

Organised crime activities in Australia and globally is continuously evolving, with an increasing awareness of the need to investigate the complex and diversified phenomenon across all economies, communities and countries. Contributing factors for this need include insufficient data, information and knowledge regarding the activities, evolution of technology, free trade and open markets, sophistication of criminals, and so forth. Morison (2002), Allach (2011) and von Lampe (2012) reiterated the extent of these factors, as well as the requirement for researchers and law enforcement investigators to join forces and develop a common overarching conceptual/exploratory model that could be utilized by both parties to investigate applicable crime cases and to build a knowledge base for future investigation efforts.

For this reason, this chapter presents a novice attempt to delineate a model which could ultimately be used to develop such overarching conceptual framework to scrutinise and unpack complex organised crime cases. The model is called the Organised Crime Reconnaissance Model (OCRM) and encompasses three major components, i.e. acquisition, internal organised crime analysis engine and responding components. The core of this model is the internal organised crime analysis engine as it implements the system processing capabilities, which include, among others, network science and general crime analysers. The three major components comprise fifteen sub-components which provide the acquisition, analyses, intuitive interaction and feedback functionalities to researchers and law enforcement investigators.

Further to the model, a comprehensive application strategy for implementing the model is also offered. The strategy is based on an eight steps inter-related process that extends from case initialisation to assimilating and inferring the results of the investigation. One of the strong points of this implementation process is that it is flexible, which means that one or more steps can be automated by a software package, whilst others are conducted manually.

In the next chapter, the artifact of the model and implementation strategy, are evaluated practically by means of a software prototype. Moreover, the focus for this chapter is to determine the practical feasibility and usefulness of OCRM to researchers and law enforcement investigators.

Chapter 8

The Prototype: OCIPS

The Prototype: OCIPS

This chapter focuses on:

- Delineating the prototype environment;
- Articulating the test case scenarios used for testing proof of concept;
- Presenting the overall test results; and
- Discussing the results and effectiveness of the prototype.

8.1   Introduction

The exigency for developing an overarching conceptual model to investigate the complexities of organised crime has come to prominence in previous chapters, which had resulted in the articulation of an exploratory model called Organised Crime Reconnaissance Model (OCRM). The model comprises three major components, i.e. acquisition, internal organised crime analysis engine and responding components. In addition to the compilation of the model, a comprehensive application strategy for implementing the model was also articulated.

Moreover, the design science research process paradigm (DSRPP) was nominated as the design methodology of choice and it was exerted as design framework to plan and develop OCRM. Further to that, it was concluded that DSRPP will also be used as appraisal framework to evaluate the effectiveness and relevance of the new model. Figure 8.1 depicts DSRPP and the grey-out section, i.e. stage 3, is forming the nucleus of this chapter. Consequently, chapter 8 is concentrating on demonstrating the proof of concept and practical feasibility of OCRM. Oliver (2004) asserts that prototypes are well suited to demonstrate proof of concept and to validate the practical feasibility of new conceptual models. Gonzalez (1995) agrees with Oliver and highlights the usage of rapid prototyping as a common development technique to test practical feasibility. The author argues that rapid prototyping meritoriously exploits the flexibility and efficacy of commercial-of-the-shelf programs to create a working prototype of the envisioned final system with minimum effort and financial cost. Moldovan (2011) concurs with both Gonzalez and Oliver, and illuminates the pervasive use of rapid prototype technologies in all major sectors of the world economy. The author points out that, in general, 32 per cent of all prototyping projects are carried out in the automotive industry, whereas 8.2 per cent are conducted in research academies world-wide. Hence, rapid prototyping is well accepted in both formal research realms and industries to proof concepts and validate practical feasibility, and is therefore elected to be used in this chapter to evaluate OCRM.

The purpose of this chapter is to demonstrate that OCRM can be used to investigate organised crime cases and that the new model has merit. Also, the aim is to demonstrate that the model can be practically implemented by both law enforcement investigators and academics to examine, control and counteract organised crime in real-life environments.

The chapter commences with an explication of rapid prototyping where special attention is drawn to a suitable prototyping-based methodology. This is followed by a description of the test environment, which includes an explanation of the test design for testing eleven test case scenarios. Next, the results obtained through executing the test case scenarios by means of the rapid prototype are articulated, followed by a critical evaluation thereof. Finally, the chapter ends with a short conclusion.
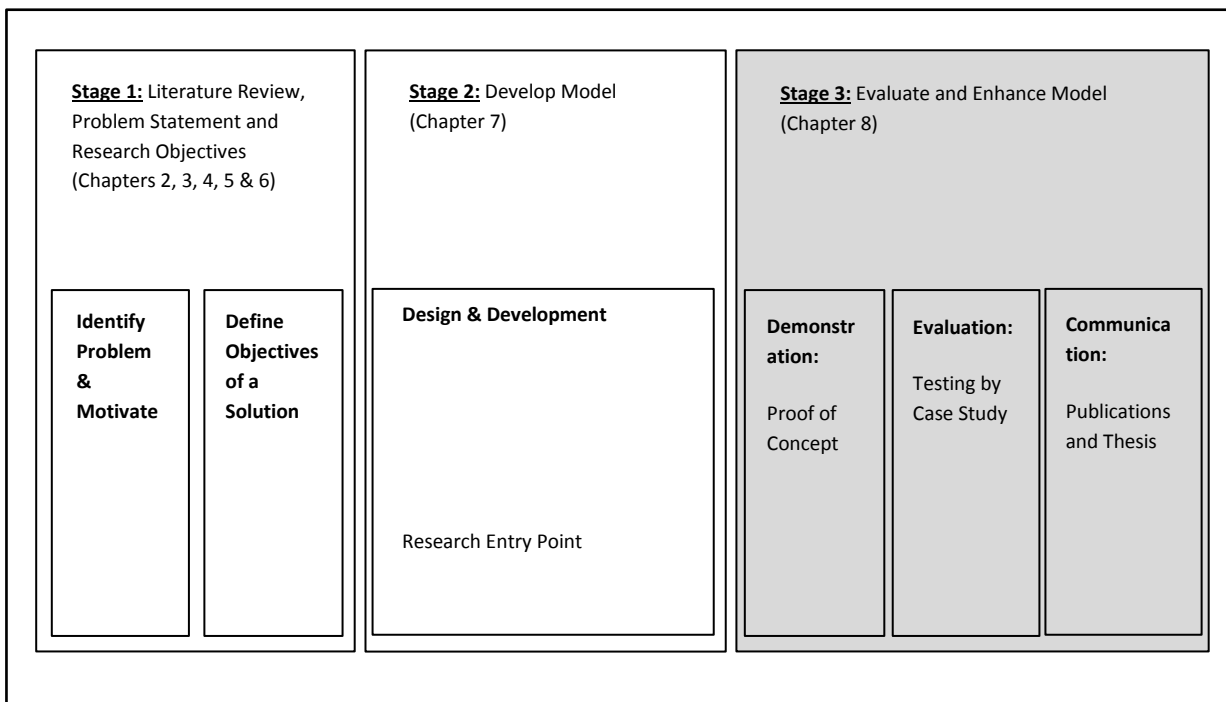
Figure 8.1 Applied Design Science Process Paradigm for Research Issue II [Adopted from: (Peffers et al., 2008)].

8.2   Rapid Prototyping

As mentioned in the introduction, prototypes and in particular rapid prototyping is often used by academics to proof a concept due to their low development effort and cost. In fact, Kordon and Luqi (2002) strongly recommend using rapid prototyping to determine feasibility of newly developed conceptual models. As rapid prototyping is used as the corner stone for demonstration and evaluation in this chapter to proof the concept of OCRM and to determine practical feasibility, the aim of this section is to elaborate more on the concept of rapid prototyping, approaches available to develop sound rapid prototypes and a prototyping-based methodology.

8.2.1 The Concept of Rapid Prototyping

Rapid prototyping is an instantiation of the term prototyping; the IEEE defines prototyping as "a development approach promoting the implementation of a pilot version of the intended product" (Kordan & Luqi, 2002, p.817). In terms of this definition of the IEEE, rapid prototyping places greater emphasis on developing prototypes very early in the development process to permit early feedback and analysis as to whether or not a model is both technical sound and practical feasible. Thus, in this context, rapid prototyping is normally employed to implement the main functionalities/components of a new model quickly and effectively with significantly less effort than it takes to produce an implementation of a fully developed practical model.

Moreover, Kordon and Luqi (2002) proclaim that the effectiveness of rapid prototyping in proofing the concept is largely determine by how well the non-important components of the model under consideration are culled, i.e. which fundamental components or functionalities should be reproduced by the prototype and which ones can safely be neglected without impacting the final results or conclusions.

In terms of OCRM, section 7.5 describes the three major components of OCRM, viz. acquisition, internal organised crime analysis engine and responding components. The acquisition component refers to the various data sources that could be exerted to provide case information. The case study analyses in chapter 6 has pointed out that various sources of information are available, albeit that the data might be in different formats. As chapter 6 and appendix B have demonstrated how the acquisition component could be implemented, this component would not be included per say in the prototype. In addition, the eleven cases analysed in chapter 6 are also used for testing and evaluating the prototype. Therefore, no requirement exists to interface the prototype with external information sources. Hence, the acquisition component is excluded from the prototype implementation.

Likewise, the prototype is not measuring hardware, software and middleware execution performances – the focus is to prove that OCRM can be used to investigate organised crime cases and to ascertain whether or not it could be implemented through automated software package in conjunction with manual interactions. For this reason, the responding component is also discarded from the prototype. Notwithstanding this, it is important to note that the graphical user interface provided by the off-the-shelf product is offering sufficient 2D and 3D visual information to exhibit crime network dynamics.

Furthermore, the information collector & refiner, central DBMS, internal database & knowledge base, visualization engine and management sub-components provide either overall management services or interact with one or both of the acquisition and responding components. As a consequence, they will also be omitted from the prototype as they have no direct impact on the end result.

However, the four core sub-components of the internal organised crime analysis engine are included in the prototype as they implement the network science concepts and five steps exploratory approach related to OCRM.

8.2.2 Approaches Available to Develop Rapid Prototyping

Two main stream development approaches exist to cultivate rapid prototyping, namely throw-away and evolutionary approaches (Kordan & Luqi, 2002, p.817; Gordon & Bieman, 1995, p.85). The throw-away approach for rapid prototyping refers to the development of a prototype, predominately by means of a universal off-the-shelf product, after which the prototype is discarded and no parts of the prototype are used in the final delivered product. On the contrary, an evolutionary approach is normally developed in more detail by a series of prototypes, in which all or parts of the prototypes are retained in the final delivered product.

According to Kordon and Luqi (2002), throw-away prototypes are best suited to demonstrate feasibility of new concepts (i.e. useability aspects of the model) and where available resources and development funds are limited. Evolutionary approach is more appropriate where precise specifications for all the components in the model under consideration are clearly defined and documented, and where both useability and structural aspects of the final product are tested.

The development requirements for the prototype in this chapter are to construct and implement a suitable prototype to prove the concept and practical feasibility of OCRM rapidly, accurately and cheaply. There is no requirement to develop an efficient, complete, portable or robust prototype as the development of the final product falls outside the scope of this project. Consequently, the throw-away prototype approach is employed to create the rapid prototype.

8.2.3 Prototyping-Based Methodology

The general prototyping-based methodology depicted in figure 8.2 encompasses four stages, namely problem or requirement definition, constructing thrown-away prototype, assembling model prototype and developing the final system. According to this methodology, both throw-away and evolutionary prototyping approaches can be used at different stages in the same project. The problem or requirement definition and constructing throw-away prototyping stages relate to the throw-away prototyping approach, while the constructing model prototype and developing the final system stages refer to the evolutionary prototyping approach.

Noteworthy is the entry path in the development process. Researchers could opt to enter the process by conducting a throw-away prototype only, or by piloting an evolutionary prototype only, or by performing both throw-away and evolutionary prototypes. As the development requirements for the prototype in this chapter are to construct a suitable prototype to prove the concept and practical feasibility only, the selected entry point for applying this methodology is stage one, followed by stage two. Stages three and four are therefore discarded for this project. The problem or requirement definition for this project is centred on the implementation of the four sub-components of OCRM and the preliminary design is articulated in more detail in the next section.

The throw-away prototype implements the preliminary design by means of off-the-shelf software products. The execution of the two stages is typically repeated a number of times, until the desired final design document is completed. For this project, the execution of stage one is preformed once only as the problem or requirement definition is well understood and set. However, stage two is repeated for each of the eleven cases to highlight that the concept of OCRM is plausible for a variety of substantive cases.

This section briefly introduced the concept of rapid prototyping. It was concluded that a prototype is an internationally acceptable method to prove the concept and practical feasibility of OCRM. Furthermore, the throw-away approach is selected to develop the prototype as it provides reasonable functionality of the final product at a low cost and relative short development period. Next, the implementation domain for the prototype is articulated.
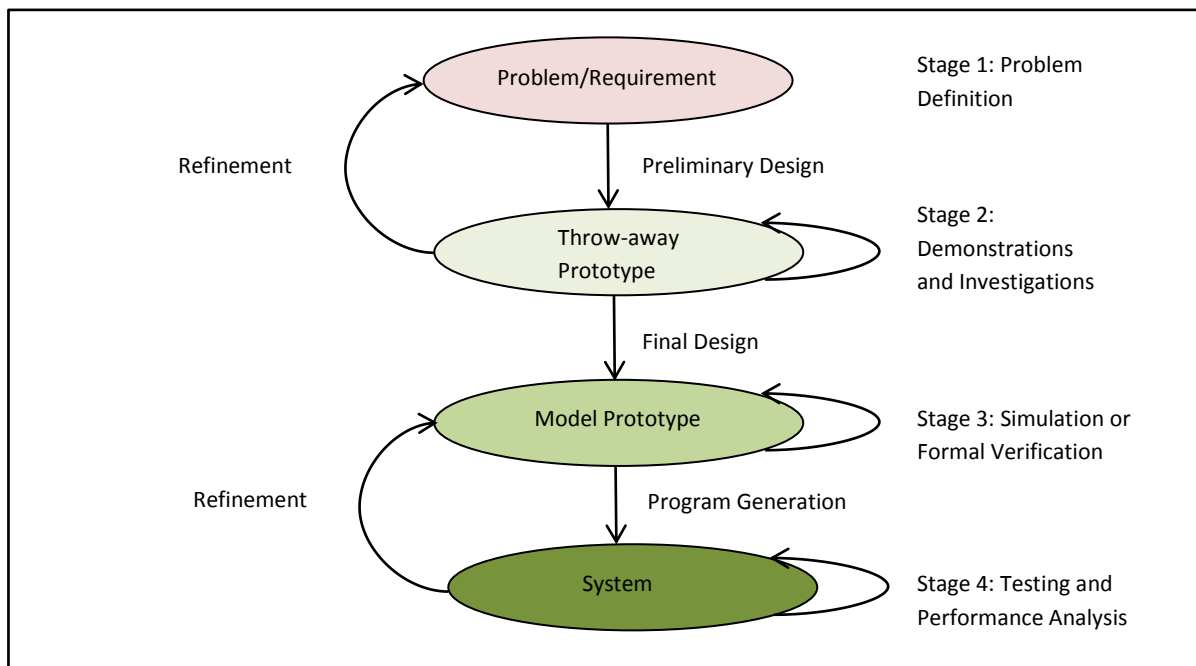
Figure 8.2 Prototyping-Based Methodology [Adopted from: (Kordon & Luqi, 2002)].

8.3   Test Implementation Background:

Having defined the prototyping approach and methodology in the preceded section, the focus is now shifting towards the testing environment. In order to proof the concept of OCRM, it is imperative to articulate a clear preliminary design, in order to create a working prototype of the model which implements the identified functionalities and to 'test' the prototype with actual data sets. As highlighted by Kordon and Luqi (2002), the preliminary design is mainly concerned with the translation of the problem statement/requirement into low level functionality requirements of the prototype. Therefore, the preliminary design for this prototype excludes the usual introduction,

background, diagrams, and so forth, as all are included in preceded chapters; the focus of this design is to list the required functionalities of the prototype.

Consequently, based on the functionality requirements recorded in section 7.3, the working prototype must provide the following feature sets to allow for meaningful testing on substantive organised crime cases:

- The prototype must have the ability to import data from a variety of formats, such as from Microsoft Excel.
- The prototype must have the capability to allow for editing the nodes (e.g. offenders, tasks, organisations and so forth) and edges (e.g. relations) within and across networks. This includes the ability to add and delete nodes and edges, merge nodes and add or delete attributes of nodes.
- The prototype must have the facility to apply standard graph and network theories, as articulated in chapter 4.
- The prototype must have the ability to compute both local network measures and global network measures, as outlined in chapter 4.
- The prototype must be capable of generating high-level reports, which should include results of calculation of both local and global network measures, network questions (e.g. who is the emergent leader and so forth) and simple descriptions of the meaning of the results.
- The prototype must be equipped with visualisation tools to allow for visual presentation of both static and dynamic networks and identification of important aspects of the network, such as key actors, groups and trends. The visualisation tools should include, as a minimum, 2D and 3D graphing.

In addition to defining the preliminary design for this prototype, it is also important to clearly define the testing environment, as it is providing a roadmap (clear understanding) of how and in which format the functionalities are provided. Figure 8.3 presents the implementation and testing environment for the prototype for this project and is termed Organised Crime Investigation Prototype System, or also referred to as OCIPS. OCIPS is grounded on the throw-away prototyping approach and encompasses three major components, i.e. case study and context analyses component, data storage component and prototype component. Each of the sub-components is described in more detail below.
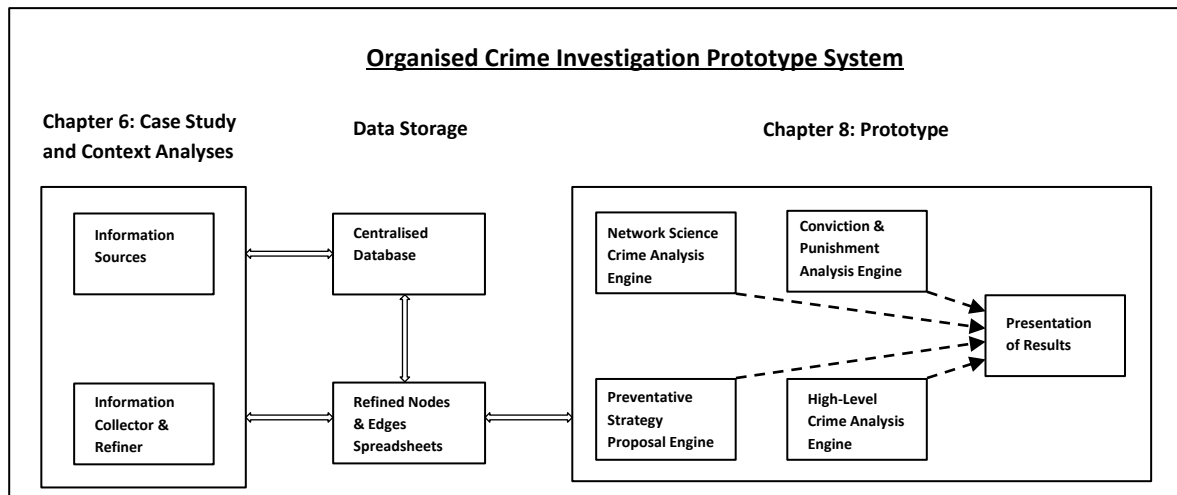
Figure 8.3: Schematic Representation of the Proposed Testing Environment.

8.3.1 Information Sources

The information sources identified for prototyping OCRM include both news media and user defined additional information sources. Public available news and internet articles for the eleven cases identified in chapter 6 and court transcript documents are used to provide background information, and to complete the questionnaire in appendix B.

8.3.2 Information Collector and Refiner

The collection of relevant data for further processing is conducted by executing context analysis on each data set in the respective information source. NVIVO 10, a qualitative data analysis tool, is used to organise, analyse and find insights from the collected data sets. The findings of the context analysis process are then applied to complete the questions/options in the questionnaire and saved in various Microsoft Excel spreadsheets.

8.3.3 Centralised Database

The storage of data sets and other relevant measures are jointly performed by NVIVO software package and Microsoft Excel. In general, all text related information is saved in NVIVO software package, whereas the results of the questionnaires are stored in Microsoft Excel. Moreover, all the results and visual output of the four core engines are also saved in Microsoft Excel.

8.3.4 Refined Nodes & Edges Spreadsheets

The final step in the data preparation process, before the questionnaire could become useful for the four engines, is to translate the results into graph and network theories' notations. For this reason, 42 node classes and 54 connection matrixes (also known as networks) for each case study are created in Microsoft Excel and saved as .csv files.

8.3.5 Network Science Crime Analysis Engine

The network science crime analysis engine is a commercial off-the-shelf software toolkit called ORA-NetScene, which implements the methodology and functionalities of this engine as outlined in section 7.5. ORA-NetScene was selected as it has been used highly successful in law & military, health, general planning and text analysis to assess covert activities, public health, hospital safety outcomes and terror groups (Carley, 2014, p.9). The 96 node classes and network files are imported into the toolkit, after which it computes the local and global network measures and applies social network algorithms to identify key actors, key topics and hot spot activities, as well as identify communities, sub-groups and patterns of interest. The results are presented in a variety of reports and are summarised in a high-level crime analysis result table in Microsoft Excel. More information on the implementation of ORA-NetScene is provided in the next section.

8.3.6 Conviction & Punishment Analysis Engine

Microsoft Excel is also used to implement the methodology and functionalities of this engine as outlined in section 7.5. The appropriate measures are automatically inserted in a separate spreadsheet, called conviction and punishment analysis sheet, dedicated to this engine, after which the mathematical capability of the program is used to compute the recommended conviction outcome and appropriate punishment/penalties.

8.3.7 Preventative Strategy Proposal Engine

The methodology and functionalities of this engine is likewise implemented by ORA-NetScene and Microsoft Excel. Important actors (members) from the organised crime group are sequentially eliminated from the Meta-Networks. Thereafter, all the local and global network measures are re-computed and comparisons are being made with previous measured results. The outcome of this process is saved in a separate spreadsheet, called preventative strategy proposal.

8.3.8 High-Level Crime Analysis Engine

The high-level crime analysis engine generates an overall crime report in a separate spreadsheet, called high level crime analysis report, as outlined in section 7.5. A predefined table collects network measure results from various spreadsheets and collate, organise, segregate and aggregate the data so that the researcher could analyse the entire case at once.

8.3.9 Presentation of Results

ORA-NetScene and Microsoft Excel are employed to provide high-end visualization functionalities to the prototype. ORA-NetScene provides both intuitive visualization graphing tools and tabular visualization on networks, and allows for user interaction with the data. Some of the visualization tools available include 2D network graphs, 3D network graphs, pie charts, spider graphs, scatter plots and histograms. As indicated above, an overall crime report is also available via Microsoft Excel spreadsheet.

The carefully chosen testing environment for studying OCRM has been proposed. This environment is called OCIPS and utilizes predominantly an off-the-shelf network analysis toolkit and standard Microsoft spreadsheet program to implement the four core sub-components of OCRM. Moreover, OCIPS comprises nine interlinked components, which perform data storage, computation and presentation functionalities. The next section is providing a general overview of how static network analysis, dynamic network analysis and network science are implemented by means of the ORA-NetScenes toolkit.

8.4 Implementation of ORA-NetScene

ORA-NetScenes toolkit has been selected to implement network science crime analysis engine, preventative strategy proposal engine and high-end visualization functionalities for the prototype. In order to get a broad-spectrum understanding of how various test cases are analysed in OCIPS, this section is providing a general high-level overview of the basic feature sets of ORA-NetScenes, a basic methodology to be followed in order to compute the various measures, a method to analyse the computed data and a procedure to visualise the computed data.

8.4.1 Overview of Feature sets of ORA-NetScenes

ORA-NetScenes is an analytic tool developed by CMU and Netanomics, that enable researchers to construct, analyse, visualise and predict both network and actor behaviour over time. The researcher of this project thanks CMU and Netamonics for permitting the use of the software toolkit for academic research purposes. ORA-NetScenes empowers researchers to infer and reason about networks at the node (local), group and network (global) levels. Although the toolkit can operate on a variety of platforms, such as LINUX and MAC, the implementation for this project operates on a Windows PC platform.

The toolkit utilizes network theory, social-psychology, operations research and management theory to compute a series of centrality and criticality measures. The underpinning pillars (i.e. people, knowledge and tasks) on which these calculations are conducted, are highlighted in table 8.1. As accentuated in the table, network measures and social algorithms used in the toolkit for computing results, are based on six distinctive networks, i.e. social network, knowledge network, information network, assignment network, needs network and precedence network.

	People	Knowledge	Tasks
People	Social Network: Who knows Who.	Knowledge Network: Who knows What.	Assignment Network: Who does What.
Knowledge		Information Network: What informs What.	Needs Network: What knowledge is needed to do the Task.
Tasks			Precedence Network: Which task must be

			done before Which.

Table 8.1: ORA-NetScenes Calculation Pillars.

Furthermore, these networks are constructed through links (relationships) and ten classes of nodes, viz. agent, organisation, knowledge, resources, belief, event, task, location, role and action. ORA-NetScenes grouped these node sets and networks under the umbrella of a meta-network. Hence, meta-network is the representation of a group of networks. For each organised crime case, one meta-network is created comprising 42 node sets and 54 networks.

Most of the basic interactions with ORA-NetScenes are conducted within the start-up interface. Figure 8.4 depicts the start-up graphical user interface (GUI), which includes the six most important entities of the interface. The entities are numbered one to six and are as follows:

- ①Menu – Grouping the majority of functionalities of the toolkit.
- ②Toolbar – Shortcuts to main functions, such as Meta-Networks, Node Classes and Networks.
- ③Toolbar Button Adder – Enables researcher to append menu functions to the toolbar.
- ④Meta-Network Manager – This pane exhibits all Meta-Networks.
- ⑤Editor – This pane displays information about Node Classes and Networks.
- ⑥Reports – This tab allows for reports to be generated on Meta-Networks.
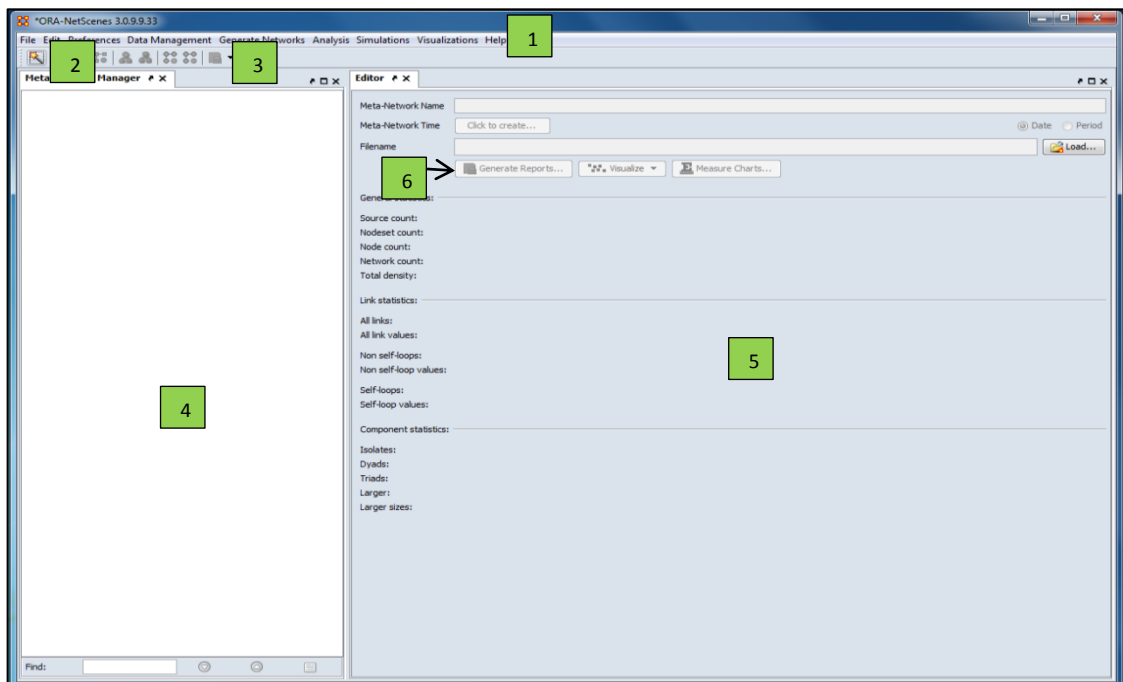
Figure 8.4: Graphic Representation of the Start-up Graphical User Interface of ORA-NetScenes [Adopted from: (Carley 2017)].

8.4.2   Basic Implementation Methodology

The basic implementation methodology for conducting a simple one-mode-one-time-period experiment in OCIPS is grounded on a three-step approach. The three-steps are as follows:

- Step 1 – Import Data. Utilize the import wizard to import the 42 node classes and 54 networks for each case as created in Microsoft Excel.
- Step 2 – Analyse Data. Generate one or more of the 24 reports, such as Standard Network Analysis Report and Key Entity Report. All reports can be generated via the Analysis menu item or Generate report tab. Moreover, further inferences can be drawn by comparing the measures in the various reports.
- Step 3 – Visualise Data. Use any of the six visualisers to picture the results and networks, as well as interrogate the findings. The most often used visualiser for this purpose is the 2D graphical visualiser, which depicts nodes, links (relationships), cliques and so forth.

8.4.3 Method to Analyse the Computed Data

Researchers are advised to compile and study all 24 reports. However, as a minimum, it is highly recommended that the following method is followed in order to gain good insight into each case:

- Generate a standard *Social Network Analysis Report* for all networks under consideration. Identify both local and global network measures to infer the position of each offender in the group. For instance, offenders with high total degree centrality are linked to many other members and by virtue of their position in the group have access to ideas, thoughts, beliefs and so forth.
- Then generate the *Key Entity Report*, which is assisting with the identification of key entities and groups, who by virtue of their position in the network, are critical to its operation. For example, identify the emergent leader, hub, authority and etc.
- This is followed by generating the *Sphere of Influence Report*. For each offender, identify the set of actors, groups, knowledge, resources, and so forth that influence the offender directly or indirectly, as well as other actors, groups and resources which are influenced or affected by the offender/s.
- Finally, produce the *Location Sub-Groups Report*. This report will enable the researcher to identify the sub-groups present in the network by using various grouping algorithms. For example, to determine communities and cliques within the groups.

8.4.4 Procedure to Visualise the Computed Data

As highlighted before, the 2D visualiser is used most often by researchers to picture and infer the computed data. Figure 8.5 presents the 2D visualiser and illuminates the five most important entities of the interface. The entities are numbered one to five and are denoted as follows:

- ①Menu – Sources for conducting the majority of task in the GUI.
- ②Toolbars – Main functions available to interact with the exhibited meta-network.
- ③Zoom/Hyperbolic Selector – Enable selection between sizing and fish-eye view.

- ④Zoom/Hyperbolic Controller – The slider controls the degree of function.
- ⑤Toolbar Button Adder – Allows for menu functions to be added to the toolbar by the researcher.
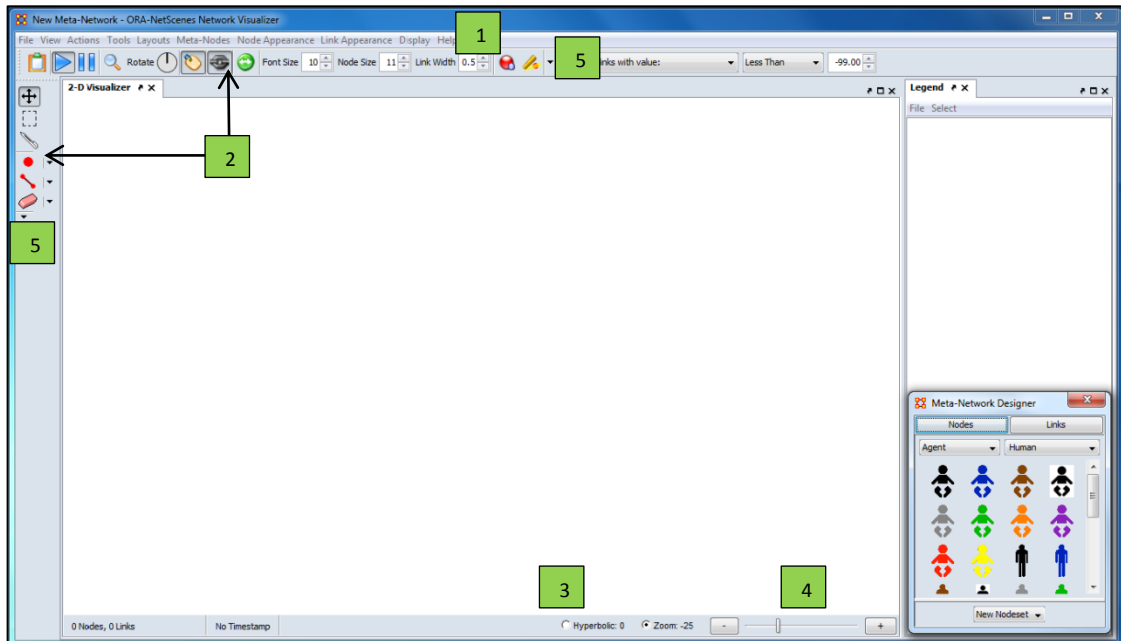
Figure 8.5: Graphic Representation of the Visualiser Interface of ORA-NetScenes [Adopted from: (Carley 2017)].

The procedure below is recommended for visualising and inferring computed data:

- Display the meta-network by selecting Visualisations > View Networks > 2D Visualization.
- Add and/or remove nodes to investigate the impact on the rest of the group.
- Add and/or remove links between various nodes to understand the impact of certain relationships in the group.
- Show or hide labels and arrows to comprehend flow of information.
- Replace nodes with icons or pictures for easier identification.
- Change the size and/or colour of nodes to highlight important attributes in the case.

A brief overview of ORA-NetScenes has been provided with the aim to enable the reader to follow the explanation of the results of the test cases in the rest of this chapter, as well as to reproduce the 'testing' process performed on the eleven substantive cases. For more information regarding the program, please consult the comprehensive help menu.

Noteworthy, as pointed out in the preceded section, ORA-NetScenes software package forms the core of OCIPS and performs most of the complex data science and intelligence analyses as proposed by OCRM. The complex algorithms embedded in the software package implement network and social-psychology theories, and are well-tested in the military and criminal realms with extremely

high success rates. Furthermore, the usage of Microsoft Excel software package is to augment and bespoke ORA-NetScenes for this research project, by performing basic data capturing and storage functionalities, as well as basic calculation processing. The next section provides a synopsis of the test design conducted for this project, as well as presenting the results for each test case scenario.

8.5   Results

Using the foregoing description on the prototype and test environment, this section is now articulating the test design, as well as the results obtained from the testing. As alluded to in the introduction, the main objective of this chapter is to proof the concept of OCRM and to comprehend the practical feasibility of the model. Oliver (2004) asserts that in general a single-case study is sufficient to proof the concept and practical feasibility. He further suggests utilizing multiple case studies to prove more general results, such as evidencing that organised crime offenders are predominately from white ethnicity, or organised crime offenders are mostly involved with human trafficking and so forth.

Based on the assertion from Oliver, it was decided to select one case (case nine) randomly and execute the entire prototype, i.e. the four core sub-components of OCRM and presentation of results component, in order to prove the concept and practicality of the model. The results, as outlined below, are then compared and contrasted against the narratives of the case to evaluate and determine the correctness and effectiveness of the implementation. Further to that, it was also decided to execute the network science crime analysis engine and presentation of results components on the remaining ten cases to create general inferences by comparing and contrasting network measures and key entity results among the various cases. As a corollary, twelve test case scenarios are considered. Please see appendix D for the results of the remaining ten cases.

8.5.1   Test Case Scenario One: Case Study Nine – Static Meta-Network

Testing of case nine is conducted in two phases, namely one-mode-one-time-period testing phase and one-mode-multi-time-period testing phase. The one-mode-one-time period testing refers to standard network analysis as articulated in the first four steps of the exploration approach in chapter 4. The foundation for this test scenario is to create a static meta-network which includes all entities for the entire criminal event that commenced on 1st of January 2002 and includes events occurring at the trial. The implementation methodology described in section 8.4.2 is executed, followed by the compilation of the overall *Crime Report* (Table 8.2), summary of *Preventative Strategy Proposal* (Table 8.3) and capturing of the screenshots of the overall *Network Diagram* (Figure 8.6) and *Core Attributes Network Diagrams* (Figures 8.7, 8.8 and 8.9). The overall Network Diagram presents the global crime structure applicable for this case, whereas the Core Attributes Network Diagrams drill down to exhibit important offender attributes and neighbour details.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.005	0.005		
1.1.2	Std Dev	0	0.029	0.008		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0.1	0.267	0.057		
1.1.5	Sum Total	36.56	56	12		
1.1.6	Number of Nodes				211	
1.1.7	Number of Links				212	
1.1.8	Average Total Degree Centrality				0.005	
1.1.9	Average Clustering Coefficient for Network				0.201	
1.1.10	Network Centralisation				0.135	
1.1.11	Network Density				0.005	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.078	
1.1.14	Network Reciprocity				0.025	2.5% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Three nodes (Offenders) have high degrees and the rest of the nodes have relative low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.005	212	1.005	1.416	
1.2.2	Network without Core Offender A	0.003	148	0.7	1.384	
	Network without Core Offender B	0.003	151	0.71	1.403	
	Network without Core Offender C	0.004	161	0.76	1.358	
1.2.3	Core 3 Nodes (Offenders)	1	3	1	2.667	
1.2.4	Residual 208 Peripheral Nodes	0.0011	49	0.24	1.214	
1.3	**Overall Network Diagram:**	See Figure 8.6				
1.4	**Core Attribute Network Diagram:**	See Figures 8.7, 8.8 & 8.9				
2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable Nodes	**Measured Value**			
2.1	Emergent Leaders:	1	Offender A (0.290)	Offender B (0.265)	Offender C (0.212)	Based on the efforts to perform their tasks and connection with others, offender A has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.

			Charged	Instance 1	Instance 2	Instance 3	
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)	Offender C (0)		There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (0.893)	Offender B (0.893)	Offender C (1.0)		Offender C acts as the information hub in the network. Thus, he is best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	1	Offender A (0.893)	Offender B (0.893)	Offender C (1.0)		Offender C acts as the authority in the criminal group. Thus, offender C is well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)	Offender C (0)		None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	3	Offender A	Offender B	Offender C		The network consists of one main clique.
2.7	No of Sub-Cliques in Syndicate:	0	N/ A				The network consists of one main clique, but cannot be further segregated into smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.984)	Offender C (0.853)		The measured values indicate that offender A is more centred in the clique in terms of the overall network characteristics and offender C is the least centred. Hence offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	3	Offender A (1)	Offender B (1)	Offender C (1)		The measured values indicate a high cohesiveness among all offenders, which possibly means that the friends of each offender are also friends with the other two members.
2.10	Least Integrated Offender in Group	1	Offender A (0.290)	Offender B (0.265)	Offender C (0.212)		Offender C uses the least cognitive effort to do its task in the group and can therefore being seen as the least integrated offender.
2.11	Group Knowledge:	1	Offender A (0.316)	Offender B (0.317)	Offender C (0.367)		Offender C has the highest group knowledge due to his exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	1	Offender A (0.45)	Offender B (0.736)	Offender C (0.4)		Offender B has the highest workload in the syndicate based on the knowledge and resources used to perform the assigned tasks.
3	**Key People in Case:**						
3.1	Offenders	Offender A	Offender B	Offender C			
3.2	Victims	Victims are General Users of Illicit Drugs.					
3.3	Witnesses	Witnesses A - N					
4	**Possible Indictments:**						
			Charged	Instance 1	Instance 2	Instance 3	
4.1	Indictment 1		One Count of Conspiracy — To import commercial quantity of drug. Contrary to Sections 307.11(1) and 11.5 of the Criminal Code (Law Part Codes: 58481, 41450).	Offender A	Offender B	Offender C	
4.2	Indictment 2		One Count of Conspiracy — To supply	Offender A	Offender B	Offender C	

Ref	Item	Description	Col A	Col B	Col C	Col D
		commercial quantity of drug. Contrary to Section 25(2) of the Drug Misuse and Trafficking Act 1985 (NSW) (Law Part Code: 68401).				
4.3	Indictment 3	One Count of Conspiracy - To pervert the course of justice. Contrary to Section 42 Crimes Act 1914 (Cth).	Offender A			
5	**Possible Conviction:**					
5.1	Offender A	Guilty with high degree of certainty.				
5.2	Offender B	Guilty with high degree of certainty.				
5.3	Offender C	Guilty with high degree of certainty.				
6	**Possible Penalties:**					
6.1	Offender A	Head Sentence: Recommended sentence of 23.8 years of imprisonment.				
6.2	Offender B	Head Sentence: Recommended sentence of 20 years of imprisonment.				
6.3	Offender C	Head Sentence: Recommended sentence of 10.2 years of imprisonment.				

Table 8.2: The Overall Crime Report for Case 9.

Mitigation Strategy:		Offender A Removed		Offender B Removed		Offender C Removed	
Ref No	Measure Description:	Computed Results:					
2.1	Emergent Leaders:	Offender B (0.207)	Offender C (0.179)	Offender A (0.232)	Offender C (0.179)	Offender A (0.282)	Offender B (0.257)
2.2	Possible Boundary Spanners:	Offender B (0)	Offender C (0)	Offender A (0)	Offender C (0)	Offender A (0)	Offender B (0)
2.3	Hubs:	Offender B (0)	Offender C (0)	Offender A (0)	Offender C (0)	Offender A (0)	Offender B (0)
2.4	Authorities:	Offender B (0)	Offender C (0)	Offender A (0)	Offender C (0)	Offender A (0)	Offender B (0)

2.5	Possible Influential Individuals:	Offender B (0)	Offender C (0)	Offender A (0)	Offender C (0)	Offender A (0)	Offender B (0)
2.6	Offender Eigenvector Centrality:	Offender B (1)	Offender C (0.871)	Offender A (1)	Offender C (0.806)	Offender A (1)	Offender B (0.946)
2.7	Offender Clustering Coefficient:	Offender B (0)	Offender C (0)	Offender A (0)	Offender C (0)	Offender A (0)	Offender B (0)
2.8	Least Integrated Offender in Group	Offender B (0.207)	Offender C (0.179)	Offender A (0.232)	Offender C (0.179)	Offender A (0.282)	Offender B (0.257)
2.9	Group Knowledge:	Offender B (0.517)	Offender C (0.483)	Offender A (0.517)	Offender C (0.483)	Offender A (0.500)	Offender B (0.500)
2.10	Overall Workload:	Offender B (0.734)	Offender C (0.400)	Offender A (0.450)	Offender C (0.400)	Offender A (0.450)	Offender B (0.734)

Table 8.3: Summary of Preventative Strategy Proposal Report for Case 9.

Figure 8.6: Overall Network Diagram for Case 9.
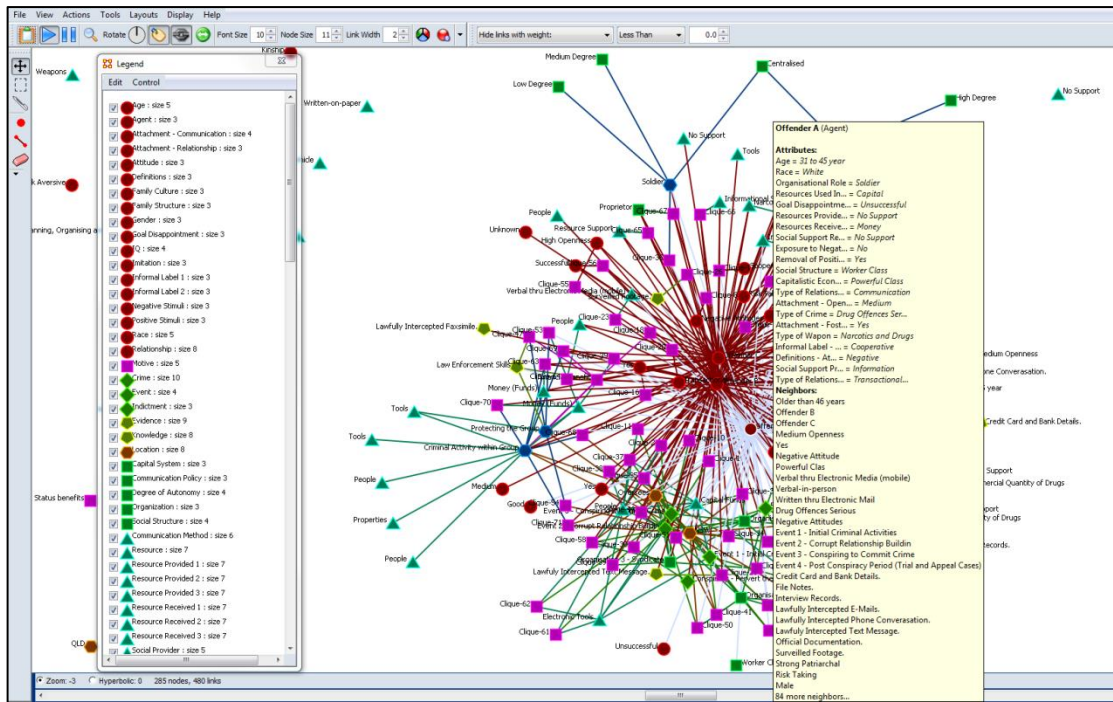
Figure 8.7: Core Attribute Network Diagram for Case 9 - Offender A.
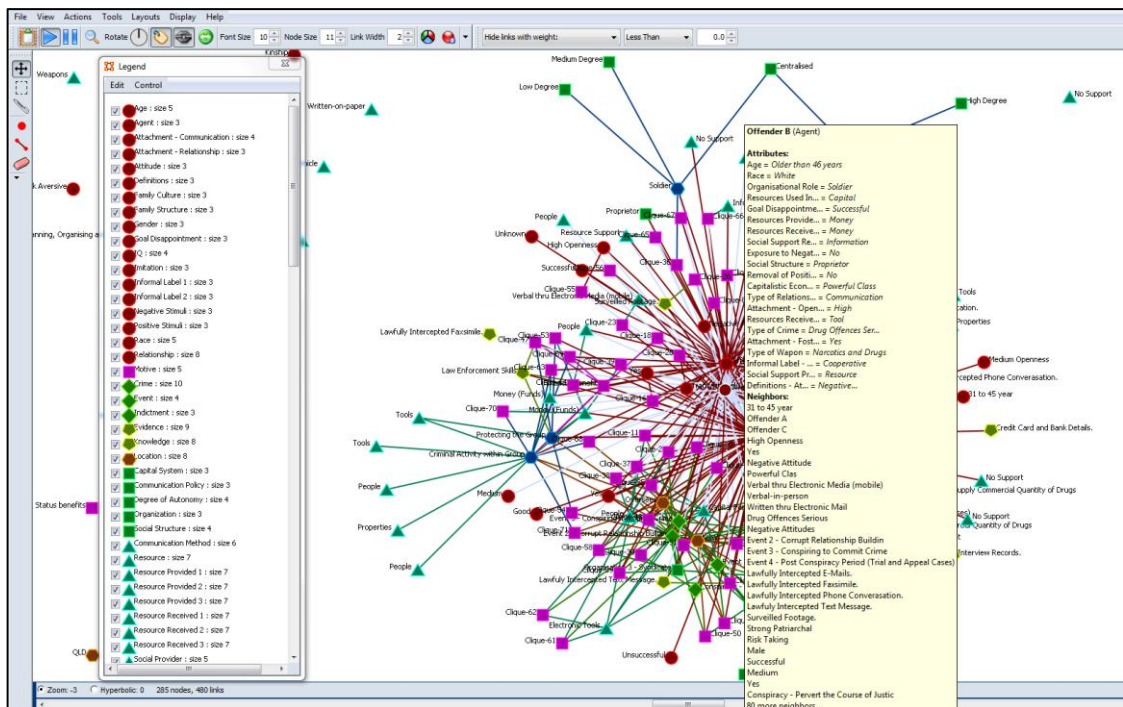
Figure 8.8: Core Attribute Network Diagram for Case 9 - Offender B.
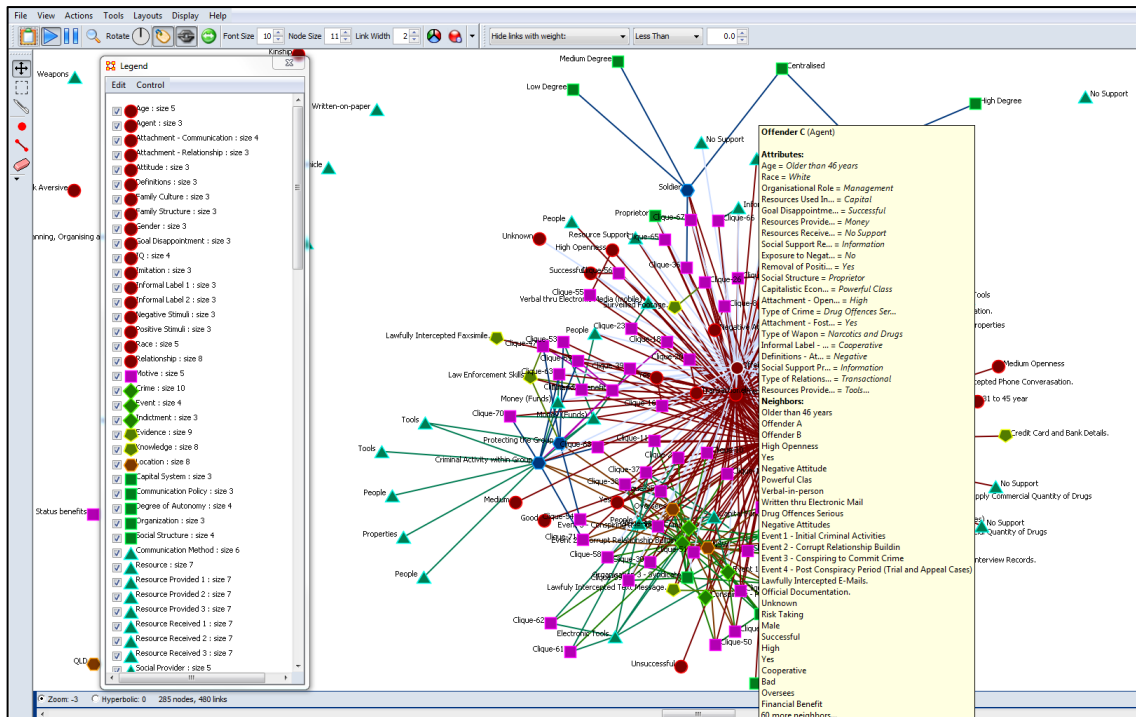
Figure 8.9: Core Attribute Network Diagram for Case 9 - Offender C.

8.5.2 Test Case Scenario Two: Case Study Nine – Dynamic Meta-Network

For this scenario, which constitutes phase two of testing case nine, a one-mode-multi-time-period testing is conducted on the data set. In essence, the static meta-network constructed for testing case scenario one is segregated into six discrete time periods as documented in the court transcript. For each period, a separate sub-network is computed for the one-mode-multi-time-period testing. The six sub-networks are as follows:

- Initial Crime Activity Meta-Network: 01/01/2002 to 31/12/2003
- Corrupted Relationship Building Meta-Network: 01/01/2004 to 31/12/2005
- Introduction to International Syndicate Meta-Network: 01/01/2006 to 30/06/2007
- First Consignment Meta-Network: 01/07/2007 to 31/12/2007
- Second Consignment Meta-Network: 01/01/2008 to 31/05/2008
- Post Second Consignment Meta-Network: Post 01/06/2008

The overall Network Diagrams for each of the sub-networks are depicted in Figure 8.10, 8.11, 8.12, 8.13, 8.14 and 8.15.

Figure 8.10: Overall Network Diagram for Initial Crime Activity Meta-Network.

Figure 8.11: Overall Network Diagram for Corrupted Relationship Building Meta-Network.
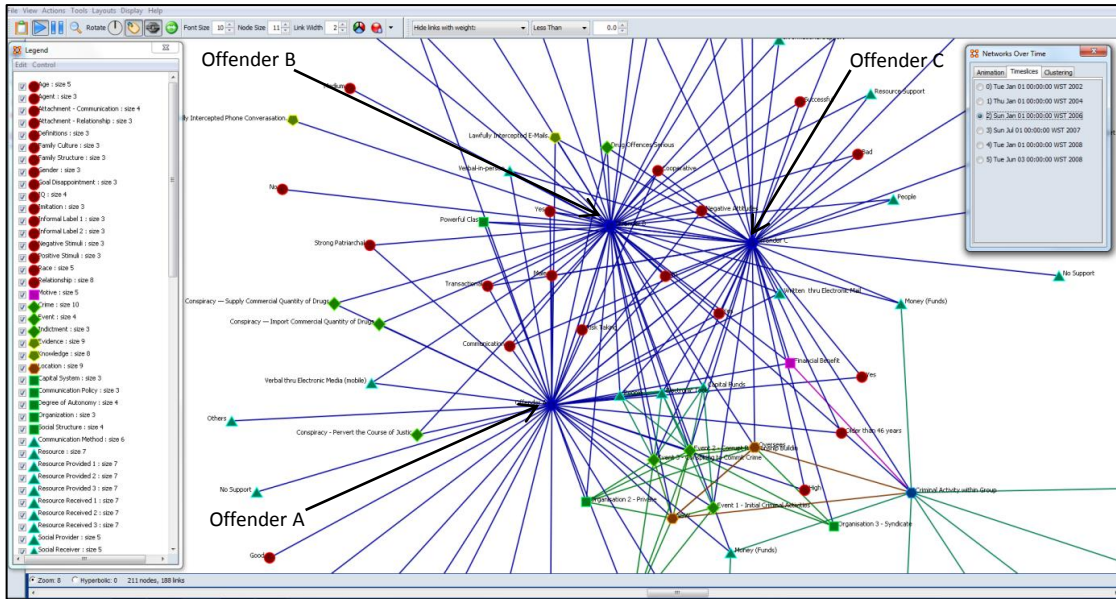
Figure 8.12: Overall Network Diagram for Introduction to International Syndicate Meta-Network.
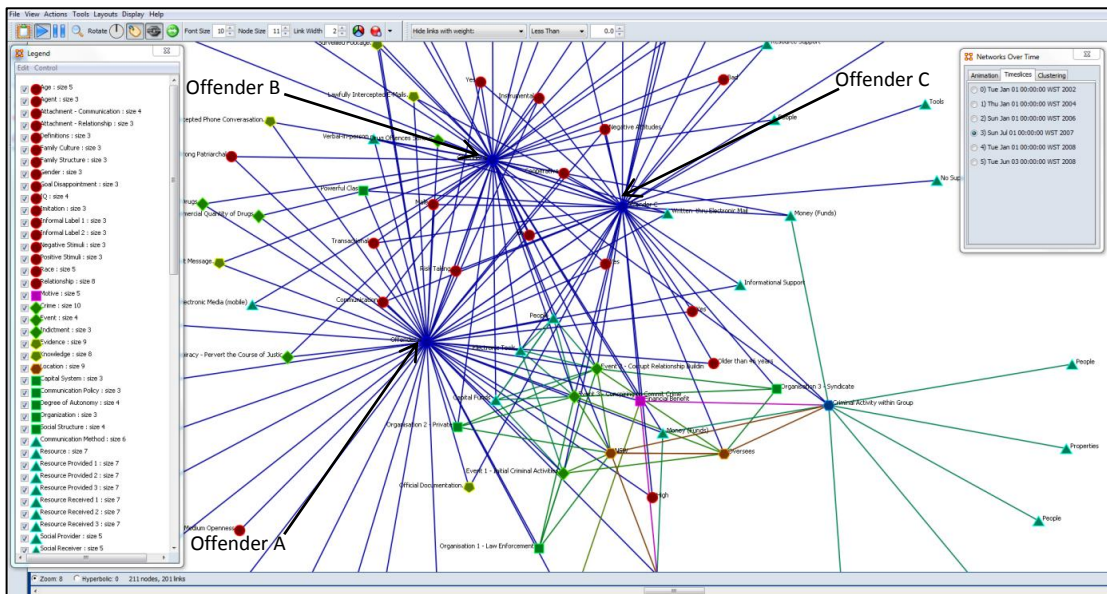
Figure 8.13: Overall Network Diagram for First Consignment Meta-Network.
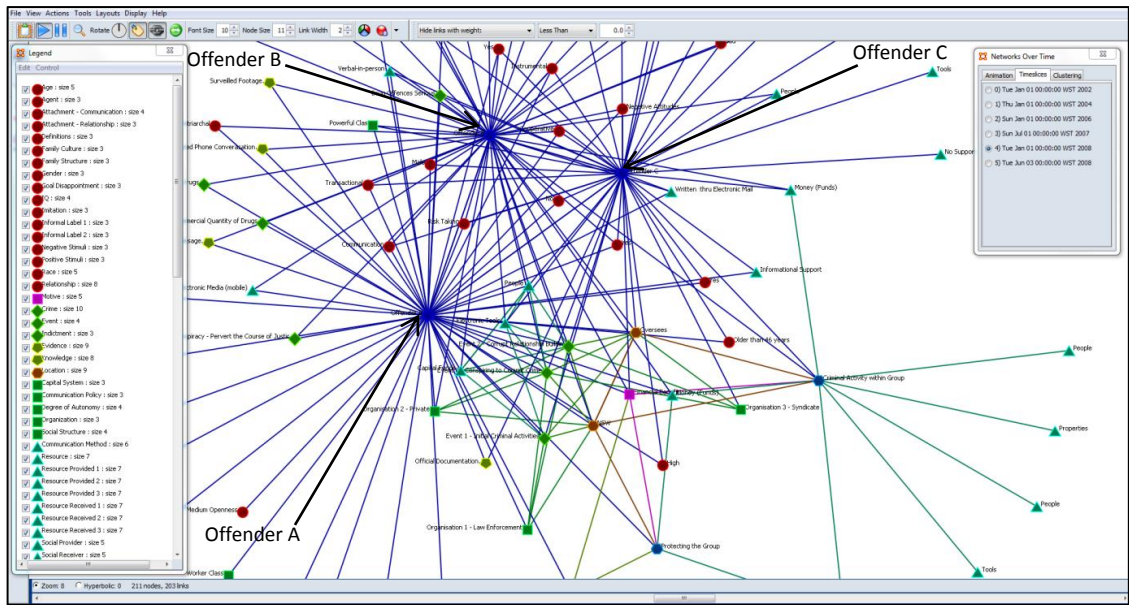
Figure 8.14: Overall Network Diagram for Second Consignment Meta-Network.
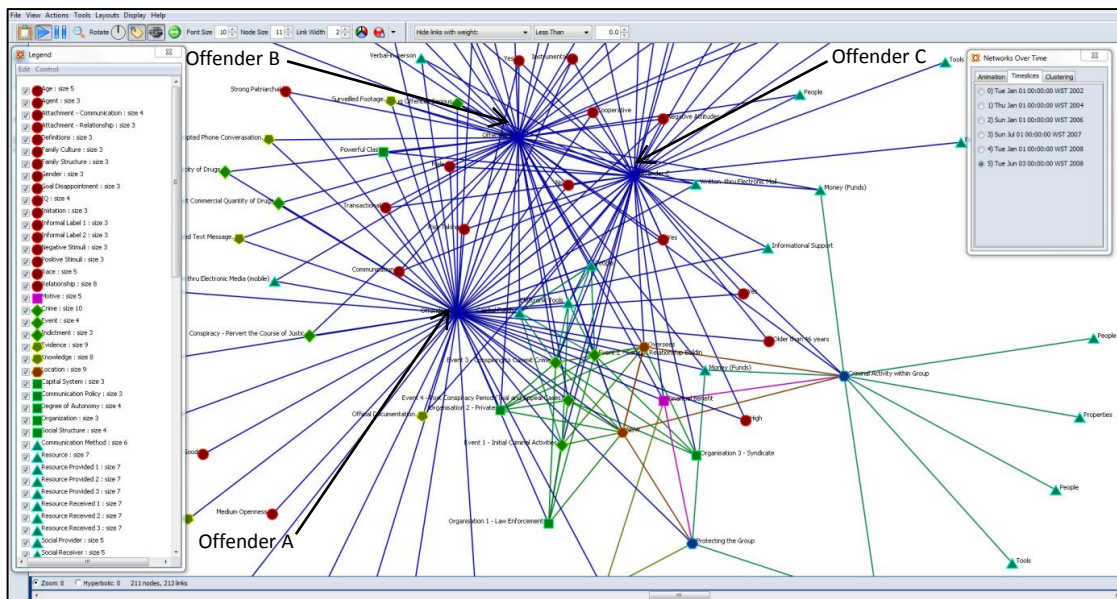
Figure 8.15: Overall Network Diagram for Post Second Consignment Meta-Network.

The implementation results of twelve test case scenarios have been briefly introduced in this section and appendix D. All test case scenarios were executed by means of OCIPS and the respective results were presented in either graphical or tabular format. Next, the results are discussed and evaluated with the aim to appraise OCRM in terms of proof of concept and practical feasibility.

8.6   Discussion on the Findings

At first sight, the results produced by executing the test case scenarios in the preceded section and appendix D might appear overwhelming and fairly analogous. However, by analysing the results more closely, it is now possible to attest the concept regarding OCRM and evaluate the practical feasibility of the model. Subsequently, this section comprises three sub-sections viz., discussion on the static meta-network for case nine, discussion on the dynamic meta-network for case nine and a general discussion in terms of the findings for all twelfth test case scenarios.

8.6.1   Discussion: Static Meta-Network for Case Nine

This discussion is focussing on figures 8.6, 8.7, 8.8 and 8.9, as well as tables 8.2 and 8.3. *Figure 8.6 depicts the overall criminal network* for case nine and is deliberated to obtain a general overview of the network. It is fairly noticeable that the network comprises a few core nodes and many peripheral nodes. The three alleged offenders (referred to as offenders in the rest of this discussion) constitute the core of the network, based on the high volume of links or relationships to and from the core nodes. In terms of the peripheral nodes, it is also evident that the four events and three organisational nodes establish a mini core due to their relationships with the offenders. When selecting the three core nodes, a list of important node attributes and information of neighbouring nodes is displayed. *Figures 8.7, 8.8 and 8.9 portray the node attributes and neighbouring node information* for each offender respectively. For instance, figure 8.7 indicates that offender A is aged between 31 and 45 years, has probably a high IQ level and received numerous resources from others. Further to that, he has two main neighbours, offenders B and C, who among others, are aged 46 years or older. Also, as the three offenders are centred in the network diagram and bi-directional relationships exist amongst them, it could possibly be concluded that strong reciprocal relationships most probably existed between offenders A and B, as well as offenders A and C.

In order to acquire a profound understanding of the network, the data in table 8.2 is evaluated next. According to the table, the *network density* for the organised crime network is calculated as 0.005. This suggests that only 0.005% of all potential links or relationships within the network of 211 nodes (212 out of 44310 potential bi-directional links) have realised and this network could therefore be categorised as a sparse or 'under-developed' network. This measure also indicates that the average node in the network has a relative low speed limit at which information diffuses among the nodes, and most nodes have low levels of social capital and/or social constraint. On the contrary, the sub-network representing the three offenders has a network density measure of 100%. This means that all potential links or relationships among the offenders have been realised and the speed at which information is diffused among them is very high. Also, the social capital and/or social constraints pertaining to the offenders are very high. The narrative of the court transcript could be used to confirm the density measure for all three offenders.

Moreover, the *degree centrality statistic* proclaims that the average node in the network has a total link measure of 0.005% for in-degree and out-degree respectively. However, the relative high standard of deviation, 0.029 for out-degree and 0.008 for in-degree, points out the large difference between the numbers of links that the three offenders have compared to the remaining nodes. Likewise, the minimum in-degree and out-degree statistics highlight the fact that one or more nodes are completely isolated. Also, the sum total for the maximum in-degree and out-degree statistics denotes that one of the offenders (offender A) has 56 out-links or relationships with other nodes and 12 in-links or relationships, which most probably makes him highly powerful, important and complicit in committing the offence. This result also resonates well with the narrative of the court transcript.

In terms of *network centralisation measure*, the toolkit computed a value of 0.135. This measure signifies a decentralised structure for the organised crime network. It also implies that other organisations, such as the international syndicates, are managed internally within their respective organisations. This assertion corresponds with statements in the court transcript that highlight the poor level of communication and management amongst the three criminal organisations.

Another important measure that requires evaluation is the *path length*. The path length indicates the level of safety and secrecy built into each criminal network. For the offender sub-network in case nine, the average path length identified between two offenders equals 2.667 hopes. This measure implies that any offender in the offender network is on average approximately two and half connections away. The measured value is a reasonably short distance, highlighting the fact that low safety and security measurements were built into the network. Evidence in the case has confirmed this contention as the law enforcement officers found it relatively easy to breach the communication channels of the offenders and to follow events.

In table 8.2, twelve general network science measures are presented to provide further insights into the criminal group. Firstly, the *emergent leader* of the group is calculated, which measures the total amount of cognitive effort expended by each offender to perform his or her task, achieve group goals and connect to other group members. Based on the efforts to perform their tasks and connection with others, offender A has been assigned as the emergent leader and could become the formal leader of the organised crime group in the future. This finding is in line with the evidence in the case, as offender A has provided group protection services and became more involved with the criminal activities as the network evolved.

Next, possible *boundary spanners* for the crime network are calculated and presented in table 8.2. In social science research the term *boundary spanner* is used to describe individuals within a social network who have, or adopted, the role of linking the organisation's internal groups with external sources of information. As the information sources provided finite information on the three offenders in terms of concurrent membership, no inferences could be made in terms of which offender acts as boundary spanner.

The following two terms under investigation are termed *hubs* and *authorities*. The term *hub* predominately refers to nodes that have out-links which are linked to nodes that have many in-links. Individuals or organisations that act as hubs are sending information to a wide range of agents, each of whom has many others reporting to them. Theoretically, an offender is hub-central if it has out-links linked to agents that have many other agents sending information to them. On the other hand, *authorities* refer to agents that have in-links which are from agents that have many out-links. Individuals or organisations that act as authorities are receiving information from a wide range of others, each of whom is sending information to a large number of others. Notionally, an offender is authority-central if its in-links are from agents that have many sending out-links to others. Based on these definitions and computed measures, offender C acts as the information hub and information authority in the criminal network. Thus, he/she is best placed to send out and receive information to and from other offenders in the network. This finding supports the evidence adduced in the case by the prosecution.

The fifth measure computed and presented in table 8.2 is *possible influential individuals* within the criminal group. Influential individuals are those agents that across all node pairs have the shortest path. Individuals or organisations that are potentially influential are well-positioned to shape interactions between groups and bring to bear the influence of one group on another or serve as a gatekeeper between groups. For an offender to be a possible influential individual, the node must occur on many of the shortest paths between other agents. Grounded on this definition and calculated measures, all offenders have the same low level of influence in the network. This inference is backed by the fact that information on three offenders only was made available and according to this information no offender has explicitly influenced any other member overtly.

Next, *cliques and sub-cliques* are computed and presented in table 8.2. In network science, a clique is a sub-group in the network that consist of three or more nodes, all adjacent to each other (noteworthy, sub-cliques in the context of this study refers to two or more clique members who have strong relationships). The significance of cliques relates to the fact that all nodes are connected through dense, direct and reciprocated choice relationships. It is important to identify cliques and sub-cliques as all members have homogeneity of thought, identity and behaviour. In terms of case nine, the network consists of one main clique and cannot be further segregated into smaller sub-cliques. Hence, based on the computed measures, offenders A, B and C have similar thoughts, identity and criminal tendencies, which were all accentuated in the narrative of the court transcript.

The eighth measure calculated and deliberated in the table refers to *offender eigenvector centrality*. This measure characterises the 'global' (as opposed to 'local') prominence or approximated importance of each node in the overall network by using the principle eigenvector given by the adjacency matrix of the network under consideration. The measured values indicate that offender A is more central in terms of the overall network structure or has more nodes connected to him/her which acquired high level of importance in the network. On the other hand, offender C is the least centred or connected to important nodes in the network. Hence, offender A is rated as the most prominent member

in the overall network. This finding supports the narrative of the case as offender A was directly connected to the other members and law enforcement agencies and indirectly connected to various international syndicates.

The following general network science measure listed in table 8.2 is called *offender clustering coefficient*. In basic terms, a clustering coefficient is a measure of the degree to which nodes in a network tend to cluster together, therefore exhibiting general cohesiveness among nodes. The measured values indicate a high cohesiveness among all offenders, which possibly mean that the friends of each offender are also friends with the other two members. Although no explicit indication regarding friendship-groups was referred to in court transcript or news articles, evidence has been provided to the court regarding a social gathering abroad where all three of the offenders gathered with their partners and associates.

The tenth recorded measure refers to *least integrated offender in group*. In social network terms, this measure rates each node in relation to their connection with other people, organisations, tasks, events, areas of expertise, and resources; it also considers their engagement in complex tasks where they may not have all the needed resources or knowledge, and so have to coordinate and collaborate with others, or have other reasons why they need to coordinate or share data or resources. Based on the preceded description and measured values, offender C uses the least cognitive effort to do his task in the group and can therefore being seen as the least integrated offender. The narrative of this case explicitly pointed out that offender C was located in the Netherlands and most of the interactions occurred between offenders A and B.

The penultimate general network science measure listed in table 8.2 articulates *group knowledge*. Group knowledge in relation to social networks refers to the highest shared situational awareness across all nodes. According to the calculated measures, offender C has the highest group knowledge due to his relationships with offenders A and B, as well as exclusive ties with other entities within the international syndicates. This finding is in line with the narrative of the case, as presented by the prosecution.

The final measure calculated and described in the table relates to *overall workload*. With regards to social network analysis, nodes are high in workload if they are doing more complex tasks and have the resources and knowledge or expertise to do those tasks. The measured values suggest that offender B has the highest workload in the criminal group, based on the knowledge and resources exerted to perform the core tasks within the organised crime network. The chronology articulated in the court transcript supports this finding as most of the activities between 1st of January 2006 and the prosecution were conducted by offender B, which could be classified as reasonably complex in nature.

In terms of *conviction and punishment* analysis results, the prototype proposed that all three offenders should be sentenced with guilty verdicts due to their involvement in the criminal events. In addition, it also predicted head sentences of 23.8 years, 20 years and 10.2 years respectively for offenders A, B, C. According to the court transcript and internet articles,

offender A was found guilty with a head sentence of 22 years, offender B was found guilty with a head sentence of six years and the conviction and punishment for offender C is unknown. No explicit information could be obtained to explain the rationale for the punishment for offender B. However, it is suspected that the offender has entered into a plea bargain with the state to significantly reduce his/her punishment.

With regards to infer a *preventative strategy*, the prototype considered the elimination of all three offenders sequentially. Table 8.3 tables the results and it is noticeable, among others, that if offender A is eliminated from the criminal network, offender B is next in line to supersede him as the emergent leader. The change in emergent leader might temporarily destabilise the criminal network. Likewise, the elimination of offender A will most probably result in the removal of the information hub and authority in the network, resulting in further destabilisation of the network. To the contrary, the elimination of offender A will most probably not have any major impact on the workload of the criminal network. Therefore, based on the results presented in table 8.3, the elimination of offender A is a plausible option.

8.6.2   Discussion: Dynamic Meta-Network for Case Nine

The graphical evolution of the criminal network for case nine is portrayed by figures 8.10, 8.11, 8.12, 8.13, 8.14 and 8.15. Two general facts have become prominent while analysing the figures, namely figure 8.10 reveals that no clear initial communication paths existed between offenders B and C; a bi-directional communication path has only been established during the corruption building phase. This implies that offender A most probably introduced the two offenders to one another. Also, based on the proliferation of relationships between nodes (group forming), the efficacy of the network has increased over time, most probably due to gaining of essential knowledge and experience in committing the various criminal activities, as well as the growth in personal cost (personal effort and resources).

In addition, ORA-NetScence further provides myriad functionalities to discover more knowledge about dynamic meta-networks, which include (but not limited to) the following (The results of these measures are presented by figures 8.16, 8.17, 8.18, 8.19, 8.20, 8.21, 8.22, 8.23 and 8.24):

- Communication Path Measure;
- Group Forming Measure;
- Personal Cost;
- Boundary Spanner Measure;
- Workload – Knowledge Measure;
- Workload – Resource Measure;
- Authority Measure;
- Hub Measure; and
- Cluster Coefficient Measure.

The communication path measure supports the observation that no initial communication path existed between offenders B and C. According to figure 8.16, offenders B and C had partial communication capabilities (value of 0.5) at the onset of the establishment of the criminal network. However, at the start of 2004, these offenders had developed their communication capabilities to such an extent that bi-directional communication existed between all members in the criminal group. Figure 8.17 summarises the group establishment process by highlighting that at the beginning of 2004, the offender group reached maturity, resulting in the formation of corrupted relationships. Moreover, figure 8.18 exhibits the gradual increase of personal cost since 2002 to 2008, reflecting the increasing commitment of the offenders to succeed with their criminal objectives.

The residual measures were discussed in the preceded section; figures 8.19 to 8.24 articulate the final value of each respective measure as discussed previously, as well as the trend-forming of each measure. For instance, between 2002 and 2004, offender A was the boundary spanner in the dual offender groups as he/she had concurrent membership in overlapping groups. Nevertheless, since 2004 the offender network evolved into one internal group, resulting in no offender with boundary spanner status.
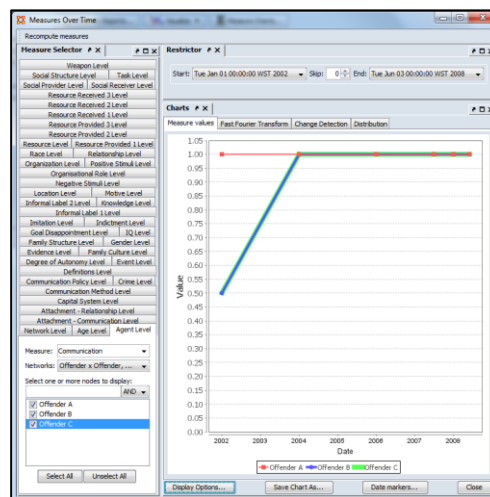
Figure 8.16: Evolution of Communication Path.
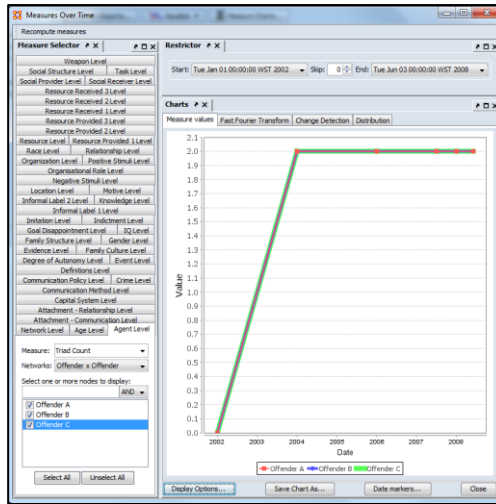
Figure 8.17: Evolution of Group Forming.
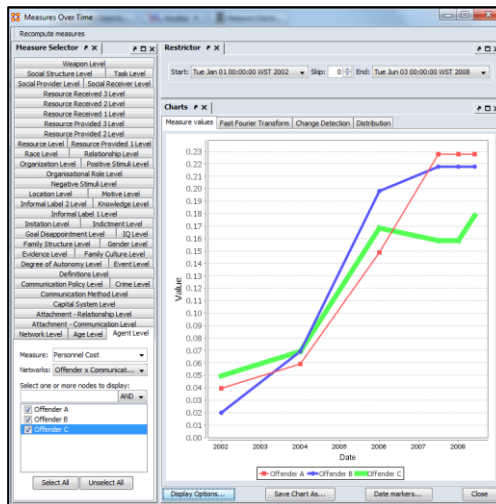
Figure 8.18: Evolution of Personal Cost.
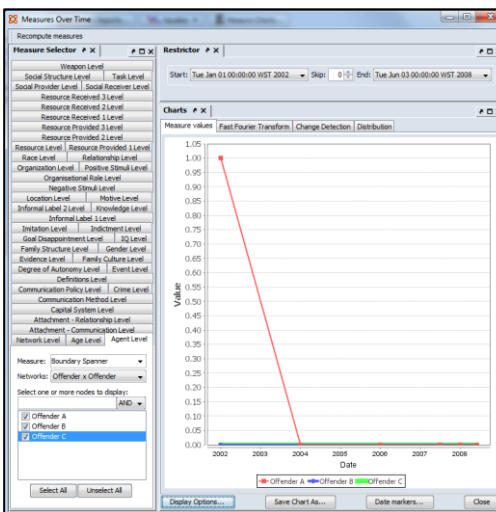
Figure 8.19: Evolution of Boundary Spanner.
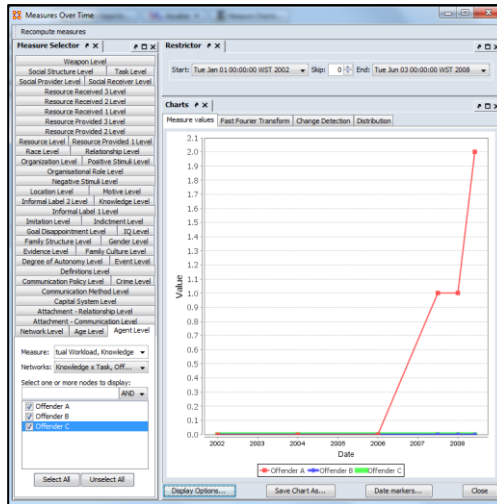
Figure 8.20: Evolution of Workload – Knowledge.
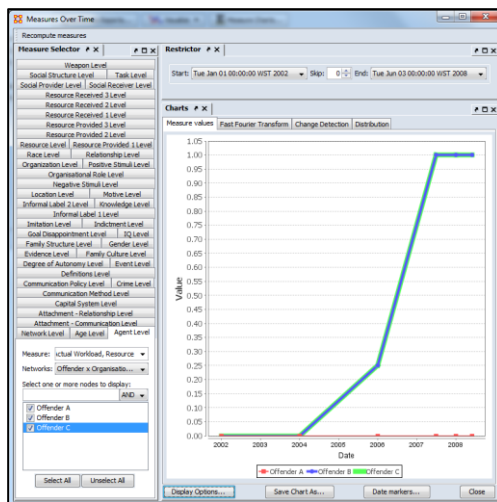
Figure 8.21: Evolution of Workload – Resource.
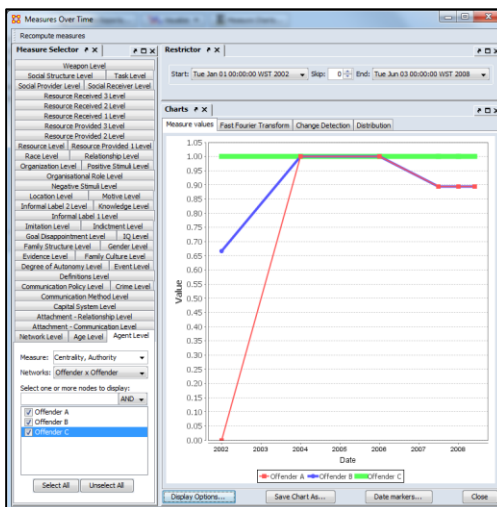
Figure 8.22: Evolution of Authority.
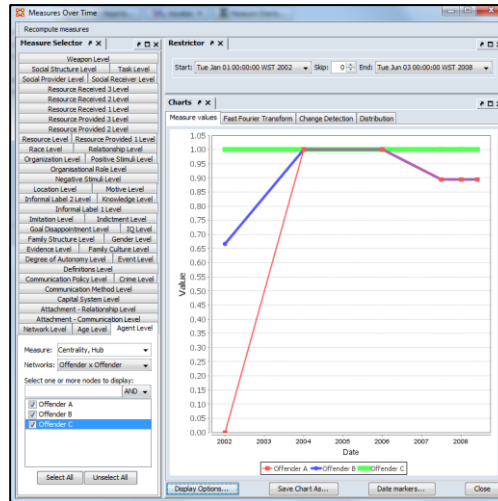
Figure 8.23: Evolution of Hub.
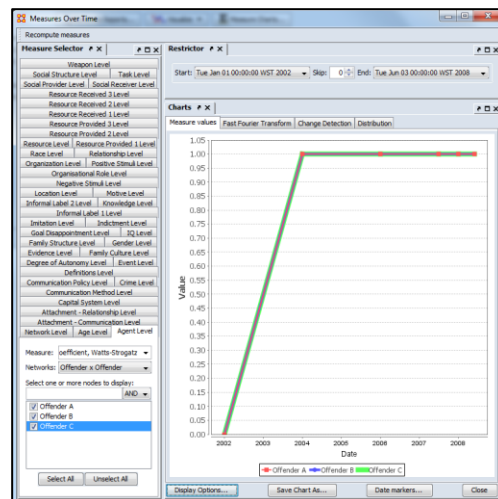
Figure 8.24: Evolution of Cluster Coefficient.

8.6.3   Discussion: General Findings

The following general observations were concluded while analysing all eleven test cases holistically:

- All networks have relative low average total degree centrality, indicating the low quantum connections between all nodes in the global network.
- All networks have relative low global clustering coefficient, which is indicative of the low cohesiveness amongst all nodes.
- All networks have relative low network centralisation, meaning that most nodes are sparsely spread across the network.
- All networks have relative low network density, denoting that only a few of all possible relationships have materialised.

- All networks exhibited low global network reciprocity, but high offender network reciprocity.

- All networks under consideration resemble scale-free network topology, which means that a few nodes have high total degrees and the rest have relative low degrees.

- In 55 per cent of cases, the offender network density equals 1, reflecting that all possible relationships amongst offenders in these cases have come to fruition.

- By applying a social network algorithm, it was possible to compute emergent leaders for all eleven test cases.

- No boundary spanners could be identified for all cases; due to the fact that only one inter-organisational group existed per case and insufficient information was available regarding external groups.

- For 64 per cent of the cases, information hubs existed for sending out information into the network.

- Likewise, for 64 per cent of the cases information authorities existed for receiving important information from other nodes.

- In 64 per cent of the cases, the dispersion of group knowledge was unequalled, which possibly indicates that offenders are informed on a 'need to know' basis.

- In 55 per cent of the cases, the workload was unevenly allocated to offenders. In most cases soldiers have a higher workload than managers.

In conclusion, this section highlighted and deliberated the test results obtained by executing the twelve test case scenarios by means of OCIPS. A diverse set of test measures was computed and discussed, ranging from local network measures to global network measures. The majority of the results illuminated that the concept of OCRM is feasible and practically executable. Hence, although the testing was done on a small scale, the results seem significant and strongly suggest that OCRM, as articulated in section 7.5, has the potential to serve as an overarching exploratory model to investigate organised crime cases.

8.7   Critical Evaluation of the Prototype

Given that the concept of OCRM and its practical feasibility have been demonstrated previously, this section is now focussing on the benefits and challenges identified during the testing process. A number of major benefits for utilizing OCIPS (which implemented OCRM) to investigate organised crime cases and to contribute to the overall knowledge database of the crime were identified, by means of testing the twelve test case scenarios and they are articulated below:

- *Capability to Construct Visual Criminal Structures relatively easily for Organised Crime Cases to Understand the Intricacies of the Network*:

   OCIPS have demonstrated the capability to practically implementing the five steps exploratory approach as modelled in OCRM to visualise the important entities of the criminal network. By visualising and exhibiting the nodes in the criminal network in two or

three-dimensional formats, as required by OCRM, the results of the twelve test case scenarios have revealed that it is possible to comprehend a complex criminal network better. Furthermore, the visualisation of the network has enabled the researcher to apprehend the importance of certain nodes, network behaviour over time, clustering of nodes, weak points of the network, and so forth.

- *Ability to Comprehend Organised Crime Networks with Limited Information*:

  The underpinning concept of OCRM is to utilize the final thirty independent variables as outlined in chapter 3 to investigate organised crime cases and to build a comprehensive knowledge base, especially in the absence of detailed information. All twelve test case scenarios were 'built-up' from limited information found in court transcripts and internet news articles. Notwithstanding the lack of detail, OCIPS have validated the ability of OCRM to meticulously investigate each case, and to confirm existing knowledge and/or to discover new facts, and infer conclusions relevant to the case.

- *Capability to Implement OCRM Practically*:

  OCIPS has been revealed to be fit for purpose to conduct the initial testing on OCRM. In this regard, it has demonstrated the ability to implement OCRM practically, albeit that the efficiency of the prototype can be questioned. Nevertheless, by following the basic implementation methodology, as outlined in section 8.4, the results obtained in the testing process have suggested that OCRM can be implemented practically in a final system product. Lessons learned through conducting the twelve test case scenarios should streamline and enhance future prototypes and system products.

In addition, a few shortcomings or deficiencies related to OCIPS were also identified and highlighted whilst conducting the test cases. The three major challenges are as follows:

- *The Efficiency of OCIPS*:

  The mechanism to execute the test case scenarios are time consuming and intense. For example, converting the content analysis output data into useable input low-level data files are reasonably time consuming and tedious tasks. An automated process and tool to prepare input files are proposed for future prototypes and system products. An initial prototype has been developed to automate the process. However, more testing is required with regards to the accuracy of the tool. This should allow for more cases to be investigated, more accurately, and in a shorter period of time to augment the knowledge database of organised crime.

- *Small Sample Size*:

  The data sampled from the 11 test cases cannot be generalised to organised crime as a whole in Australia and abroad as the same size is statistically insufficient. However, by enhancing the efficiency of OCIPS, it would be possible to test OCRM on hundreds of additional substantive cases in order to conclude additional inferences and thereby further supplementing the organised crime knowledge database.

- *Applying OCIPS in the Real-world Environment*:

    OCIPS has conclusively suggested that the concept of OCRM and the practical implementation feasibility are plausible. It also highlighted the usability of OCRM to researchers by examining case information retrospectively. Moreover, in order to comprehend the real potential of OCRM for law enforcement agencies, the model should be implemented at least through a beta system product. Law enforcement officers should then be encouraged to explore the usefulness of the model to their organisation and propose future enhancements.

Further to the benefits and shortcomings of OCIPS, the contribution of the seven social-psychological variables, six sociological variables and seven social network variables has also been investigated. As case nine is the flagship test case for this chapter, all the social-psychological, sociological and social network variables were removed in ORA-NetScenes and the results of the revised data set were compared and contrasted against the initial results. The major impact of removing the said variables is the incomplete visual description of the criminal network. Subsequently, it became more onerous to infer conclusions due to the lack of support information. Also, certain network science measures, such as overall workload, are incomputable as a direct consequence of the lack of support information.

A number of major benefits of OCRM and OCIPS are listed and articulated above, which extended from the ability to visualise organised crime networks to the capability of implementing the model practically. Furthermore, three deficiencies in implementing the model via the throw-away prototype are also highlighted and briefly discussed. Notwithstanding these deficiencies related to the prototype environment, the testing of the test case scenarios has conclusively suggested that OCRM is feasible and practically implementable. Lessons learned in executing the test cases will be incorporated in future prototypes and system products.

8.8   Conclusion

OCRM has been put to the test in this chapter, in order to demonstrate the useability of the model for investigating actual organised crime cases, especially in cases where limited data is available. The implementation was conducted via a suite of off-the-shelf software products in a test environment called OCIPS. The software packages encompassed NVIVO, Microsoft Excel and ORA-NetScences.

Twelve test case scenarios have been compiled and executed in OCIPS. At first, OCIPS executed each test case scenario independently and delivered appropriated result sets. Then, each set of results was evaluated and scrutinised for important information, inferences, accuracy and confirmation of the useability of the model. Thereafter, the respective result sets of all cases were compared and contrasted to infer holistic conclusions. Finally, OCIPS was critically evaluated to identify major benefits and shortcomings.

In conclusion, OCIPS has revealed that it is fit for purpose to conduct the initial testing of OCRM. Moreover, the evaluation of test case scenario results has suggested that OCRM could be implemented practically and be used by researchers and law enforcement officers to investigate substantial organised crime cases. OCIPS is an initial rapid prototype, aiming at proving the concept of OCRM and the implementation thereof. The next logical step is to progress with the evolutionary prototype, which includes the automation of certain processes and delivery of an operational beta software product. In future projects, the revised prototype will, in particular, focus on further testing and evaluation by law enforcement investigators, and the results will be reported through future journal publications.

Chapter 9

Conclusion and Future Work

CHAPTER 9

Conclusion and Future Work

This chapter focuses on:

- Providing a synopsis on the most important milestones in this thesis;
- Articulating the current issues and challenges associated with organised crime;
- Highlighting the solutions proposed by this thesis to address the organised crime issues and challenges; and
- Underlining the project limitations and future works.

9.1   Summary

The *proliferation of organised crime activities* during the last two decades has reignited the focus on combatting the lethal and sophisticated notorious phenomenon (Murray, 2013, p.107). As accentuated during the literature research, most of the organised crime organisations operate in a business sense, which strive to maximise their profits and minimise the risk of being apprehended (Dobovsek & Slak, 2015, p.306; Demiroz & Kapucu, 2012, p.276). Moreover, these organisations frequently obtain the necessary skill sets and expertise to ensure that they succeed in their business endeavours; the end result is high success rates and low detection rates (Murray, 2013, p.100). For this reason, many governments, law enforcement agencies and researchers are examining the phenomenon from all perspectives (i.e. strategic perspective, individual crime perspective, business perspective and so forth) with seemingly *low level of success*. Evidence of this can be seen in the ever-growing profits of illicit organisations as a direct result of the proceeds of crimes committed (i.e. global organised crime reaps illegal profits of almost $1 trillion per year) (Barker, 2017, p.1).

A *number of reasons* for the seemingly poor success rate of governments, law enforcement agencies and researchers in terms of counteracting the criminal organisations were discovered during the literature review. The most apparent reason firstly relates to the lack of a suitable universal overarching framework and/or model that could assist law enforcement and government agencies to define up-to-date, effective and innovative policies and strategies (Morrison, 2002); secondly, there is limited amount of publicly-available detailed information on actual organised crime cases that could be used by researchers to scientifically articulate the required framework and/or exploratory models (von Lampe, 2012; Morrison, 2002).

In this thesis, a *new or alternative exploratory model* has been proposed that could be utilized by the research community to scrutinise historical and current organised crime cases, as well as to develop a future comprehensive conceptual framework for organised crime. The first step in proposing the

model was to identify the key characteristics of organised crime groups. Noteworthy, the literature study has revealed a literature gap in terms of classification schemes for organised criminal groups and activities (Alach, 2011, p.56). As a consequence, the basic aspects and concepts that constitute organised crime have been investigated and collated in the format of a *holistic taxonomy*.

Subsequently, the new taxonomy has been referenced to derive a broad spectrum of attributes or variables (as it is referred to in criminology); each of them relates uniquely to the main aspects and concepts of the phenomenon. *Social-psychological, sociological and social networks theories* were further used to articulate a comprehensive set of twenty-eight independent variables. The core purpose of the variables is to ensure that substantive crime cases are investigated both holistically and individually, and secondly to ensure that cases are examined in a consistent way. Furthermore, a key benefit of these variables is that information and intelligence on most of them could readily be ascertained from publicly-available sources, thereby catering for the current lack of detailed case information.

Next, a *suitable mathematical construct* that transforms the measured variables into meaningful inferences was researched, with the main focus on cultivating an effective approach or algorithm to comprehend structural characteristics of organised crime groups. For this purpose, network science has been selected. Significantly, the research has exhibited how network science could be used to represent organised crime groups and their illicit actions through group structures and network science mathematical measures. For instance, this approach allows for the comprehension of how people or objects (known as nodes) behave inside the network structure by analysing adjacent people, objects, relationships and so forth. It also provides an understanding of how people or objects connect to one another, how strongly they are connected to the other nodes, how central they are in the network, how many short paths they belong to, and so on. The corollary of this transformation process is a comprehensive exploratory approach that collates and explores the results of the various network science measures in five sequential steps.

After articulating the set of independent variables and exploratory approach, the research focus shifted towards the *validation of the variables* in terms of how effective the selected variables are in understanding and scrutinising organised crime cases. This was achieved by conducting an extensive case study research. The case study employed content analysis to study eleven substantive organised crime cases and verify the suitability and useability of the original list of variables. During this process, additional variables were also considered that could further represent important aspects in the case. Based on the results obtained through the content analyses on the eleven cases, the data suggests that the final thirty variables are suitable and able to capture and highlight the important aspects and notions of most organised crime cases.

Following the development of the holistic taxonomy of organised crime, independent variables and the exploratory approach, the research commences with the addressing of one of the key deliverables of the project, i.e. *the cultivation of the exploratory model*. Design science research methodology has been adopted for deriving and articulating the new model due to its fundamental problem-solving paradigm that has not only its roots in engineering and the sciences of artificial, but has the academic reputation for seeking solutions for complex problems through a pragmatic approach.

The new model is called the *Organised Crime Reconnaissance Model (OCRM)* and comprises three major components, i.e. acquisition, internal organised crime analysis engine and responding components. The core of this model is the internal organised crime analysis engine as it implements the system processing capabilities, which includes among others, network science and general crime analysers. Moreover, the major components consist of fifteen sub-components which provide the acquisition, analysis, intuitive interaction and feedback functionalities to researchers and law enforcement investigators.

The final part of this project puts the new model to the test by considering the practical feasibility and useability thereof. The evaluation was conducted via an initial prototype that includes a suite of off-the-shelf software products in a test environment called *Organised Crime Investigation Prototype System (OCIPS)*. OCIPS is grounded on the throw-away prototyping approach and comprises nine interlinked components, which respectively perform data storage, computation and presentation functionalities. The prototype is operationalized through software packages, such as NVIVO, Microsoft Excel and ORA-NetScences.

In conclusion, twelve test case scenarios have been compiled and executed in OCIPS. *Two significant discoveries* were inferred during the evaluation process. Firstly, it highlighted that OCIPS is fit for purpose to conduct the initial testing of OCRM. Secondly, the results of the evaluation have suggested that OCRM could be implemented practically and be used by researchers and law practitioners to investigate substantial organised crime cases.

9.2   Issues and Challenges

This thesis identifies several problems and issues regarding the organised crime phenomenon. The most important problems are outlined and described in chapters 1, 2 and 5. Importantly, section 2.7 has provided more detail regarding the issues and challenges by analysing and summarising contemporary organised crime related research projects. The analysis of the projects accentuated a number of shortcomings, which extend from the narrow-focused approach applied by researchers to investigate organised crime to the constricted focus of certain programs due to the lack of relevant data from government agencies or the private sector. These findings have initiated new attention and efforts to further research the occurrence of organised crime, of which this research project is one instance.

Based on the illuminated shortcomings, this research project is governed by the two underpinning research issues which are outlined below:

- **Research Issue I:** Addressing the insufficient data, information and knowledge concerns that encumber effective investigation, control and counteraction against organised crime syndicates and groups.
- **Research Issue II:** Addressing the absence of a universal overarching framework/model to examine and comprehend organised crime activities more effectively and efficiently.

9.2.1 Research Issue I: Issues related to the insufficient data, information and knowledge of substantive cases.

In an attempt to address research issue I, the literature review commences with a study as to why insufficient data and information are currently available for researcher to make a positive contribution to the discipline. The key reasons identified in this thesis for the lack of detail on organised crime cases could be attributed to the below factors:

- The difficulty of securing interviews with organised crime criminals by researchers;
- The complexity and danger of observing criminals while offending for law enforcement and researchers; and
- The restricted access to official documents, such as criminal files, intellectual data and internal case statistics, amongst law enforcement agencies and researchers.

9.2.2 Research Issue II: Issues related to the inexistence of a universal overarching framework/model.

The major reasons contributing to the inexistence of a universal overarching framework/model as discovered during the literature study are outlined below:

- Many research efforts focus on a single criminal based activity related to organised crime, such as dealing with illicit drugs. However, research has suggested that most organised crime cases comprise various criminal activities, dictated by the dynamics of markets and criminal groups. Consequently, a number of general models exist which incorporate one or a few activities only.
- It appears that a number of law enforcement and intelligence agencies prefer to investigate organised crime as a mundane criminal occurrence by utilizing common investigation methods. Also, little appetite for new state of the art overarching frameworks and models is allegedly shown.
- It further seems that numerous governments are content to develop strategies and policies to counteract organised crime syndicates and groups based on contemporary trends, rather than developing and utilizing up-to-date frameworks or models.

The proliferation of organised crime and the apparent lack of success against the phenomenon in terms of monetary value, vividly highlight that these issues have not yet been adequately addressed by current studies. Consequently, this research project has endeavoured to address each of the research issues by following a meticulous and systematic two-step research methodological approach. The qualitative research methodology is adopted to address research issue I, while design science research methodology is espoused to address research issue II. The next section focuses on the actual contributions made by this research project in relation to the outcomes of each research methodology.

9.3 Contribution of Thesis (Achievements)

In order to analyse the true achievements of this thesis, this section is now articulating the main deliverables produced in this project with regards to the two preceded research issues and research questions. Several deliverables were derived to address the two research issues and each of them is briefly highlighted below.

9.3.1 Research Issue I: Issues related to the insufficient data, information and knowledge of substantive cases.

As highlighted before, informative data and information on substantive cases are fairly scarce and unavailable for most researchers, and for this reason the following deliverables were developed in the course of the thesis to overcome the issue:

- In the absence of enlightened data and information on substantive cases, the research project investigated the availability of public data and information on these cases. Various sources of data and information were found in the public domain. However, in the majority of cases it was unstructured and cluttered with non-relevant information from a research perspective. For this reason, various organised crime taxonomies were investigated to highlight which information is required and relevant for comprehending the complex phenomenon. The investigation, nonetheless, has pointed out that existing taxonomies are either out-of-date or are not fully empirically tested yet, resulting in the delineating of a new holistic taxonomy for organised crime (chapter 2).
- The new taxonomy in conjunction with general crime theories, social-psychological theories, sociological theories and social networks concepts, were used to highlight the most important aspects of a typical organised crime case. These aspects were enlisted as attributes or independent variables which should be targeted during an investigation to comprehend the phenomenon more effectively (chapter 3). The independent variables were evaluated and confirmed by means of a case study qualitative research process (chapter 6 and appendix B) and a final list of thirty independent variables is included in appendix C.
- The study also provides a vehicle to implement the thirty variables and examine organised crime without access to official organised crime case information by exploring network science and social science concepts (chapter 4). The variables can be characterised by both graphical and mathematical representation, thereby reducing the complexity of the phenomenon. A five steps exploratory approach has also been proposed to further infer the variables and important aspects of the crime, such as the importance of certain perpetrators in the group, group behaviour, clusters within the syndicate, weak points of the crime network, and potential punishment based on actions taken within the network.

9.3.2 Research Issue II: Issues related to the inexistence of a universal overarching framework/model.

As pointed out during the literature review and introduction of this chapter, there is currently a lack of up-to-date frameworks and models to describe the multifaceted concepts of organised crime, to enable and enhance meaningful investigations and to delineate

strategies and policies. For this purpose, the project delivered three distinctive deliverables as outlined below:

- Chapter 6 has strongly suggested two important inferences: firstly, that the thirty independent variables have the potential to capture and highlight the most prominent concepts and aspects of most organised crime cases, and secondly, that the five steps exploratory approach articulated in chapter 4 exhibits a well-designed method of presenting and inferring the variables. The subsequent aim was to collate the variables and approach, and to cultivate a novel model (chapter 7). The main functionalities and architecture of the model were designed by meticulously following the design science research process paradigm. The corollary of this process was a brand-new model called the Organised Crime Reconnaissance Model (OCRM).

- Another deliverable that indirectly addresses the inexistence of a universal overarching framework/model is the application strategy for implementing OCRM (chapter 7). This comprehensive strategy explicates a method of procedure to operationalize the fifteen sub-components of the new exploratory model. The strategy is based on an eight steps inter-related process that extends from case initialisation to assimilating and inferring the results of the investigation.

- The final deliverable for addressing this research issue relates to the proof of concept pertaining to the model. For this purpose, a throw-away prototype was developed that includes a suite of off-the-shelf software products. The products are integrated in a testing environment termed Organised Crime Investigation Prototype System or also referred to as OCIPS (chapter 8). Twelve test case scenarios have been compiled and executed in OCIPS as part of this deliverable. The results of executing these test case scenarios have suggested that the prototype is feasible for conducting the initial testing of OCRM and that OCRM is useable and practicable for investigating organised crime cases.

To further highlight the positive contributions of this research project, the four research questions, as defined in chapter 5, are also reconsidered to show how the thesis has managed to answer all these research questions.

- **Research Question 1:** "What are the critical attributes (independent variables) necessary for investigating nodes and relationships of organised criminal groups and activities?"

    Contribution: Research conducted on general crime theories, social-psychological theories, sociological theories and social networks concepts in conjunction with case study research on substantive organised crime cases have revealed numerous attributes in the pro forma of independent variables. Moreover, thirty critical independent variables were unearthed and ratified in chapters 3 and 6 for this purpose, which are further outlined in appendix B.

- **Research Question 2:** "Which theory or approach to behaviourism best explains and predicts individual and groups behaviour of those involved in organised crime?"

Contribution: To answer this question, the independent variables were categorised as traditional crime variables, social-psychological variables, sociological variables or social network variables. Then, content analysis was conducted on randomly selected substantive organised crime cases and each variable was accredited with the relevant data. Thereafter, variables were enumerated and normalised by scoring it as either relevant data that constitutes to 1 or irrelevant/no data that constitutes to 0. Finally, the mean value for each group of variables was computed; the group with the highest value is considered as the theory that best explains individual and group behaviour. Chapter 6 provides more detail regarding the measurement and assessment of variables.

The outcome of this process has revealed that social network variables and traditional crime variables are mostly reported on in court summary documents and news articles, whilst sociological variables are described the least of all. Therefore, social network theories and traditional crime theories best explain individual and groups behaviour of those involved in organised crime, at least from a publicly-available data perspective. Moreover, in terms of behavioural theories, the case study research has pointed out that social-psychological theories have best explicated and predicted individual and group behaviour.

- **Research Question 3:** "Do criminals follow a general and typical methodology while conducting organised crime and can it be used to investigate future criminal cases?"

Contribution: The five generic phases (viz. planning phase, preparation phase, execution phase, direction phase and control phase) executed by organised crime perpetrators, as outlined in the holistic taxonomy in chapter 2 and the case study research on substantive organised crime cases in chapter 6, were used as baseline to evaluate and answer this question. The study has shown that most organised crime criminals do follow a typical methodology, which closely resembles the five generic phases articulated in the taxonomy. More importantly, it was also discovered that most organised crime offenders valued the planning and preparation phases, as a large amount of time was devoted to these phases. Furthermore, the duration of each phase has also differentiated significantly between the cases, ostensibly due to the complexity variation of each criminal act and the number of role-players involved.

The five generic phases include a range of activities and steps that are committed by organised crime offenders in the life span of an organised crime event. It could therefore be argued that organised crime investigators could trace actual activities and steps of perpetrators to the holistic taxonomy and thereby following real events in substantive cases or, where possible, prevent offenders from committing the execution phase of the generic phases.

- **Research Question 4:** "Can an overarching framework/model be used by international research community and law enforcement agencies to effectively investigate organised crime activities?"

Contribution: This question has been discussed and addressed in detail in chapters 7 and 8 - the outcome of these chapters has confirmed the ability and effectiveness of such models. In a nutshell, Organised Crime Reconnaissance Model (OCRM) was developed as an initial overarching exploratory model that could be used by international research community and law enforcement agencies to scrutinise substantive organised crime cases. In addition, Organised Crime Investigation Prototype System (OCIPS) has not only been developed to demonstrate proof of concept for OCRM, but has also further established how the new model can be used by organised crime researchers and practitioners. In this regard, section 8.5 exhibits how researchers and investigators could use such an overarching model to investigate current substantive cases.

As underlined in this section, both research issues were satisfactorily addressed and all four research questions were adequately answered in this thesis. However, whilst conducting the research project, a few limitations and improvements were identified that could further enhance the new model. These limitations and improvements should be addressed in future research projects and are presented in the next section.

9.4   Limitations and Future Works

A number of positive contributions have been made by this research project through a substantial amount of hard work and dedication. However, as in any research project, there are still a number of caveats associated with the study that need to be acknowledged, which might affect the results and the original objectives of the thesis. The caveats are limitations which in many cases are unavoidable due to the existing constraints, such as time, availability, cost and so forth. None of the limitations identified for this project is devaluing the outcome of the project; nonetheless, they should be considered as opportunities for future research.

The core limitations and opportunities associated with this project are as follows:

- Limited sources of information used for investigating organised crime cases:

  Readily available traditional sources of information related to organised crime were considered only for this project, i.e. court summary documents and news articles. Publicly-available sources, such as Social Media and Instant Chat Services, should also be considered for future projects to provide more detail information about substantive cases. It is envisaged that these sources could, as a minimum, provide more information on relationships between different offenders, relationships between witnesses and offenders, and relationships between victims and offenders.

- Confirmation of thirty independent variables:

  For this research project, only eleven substantive cases were utilized to confirm the suitability and validity of the thirty independent variables. This project should be seen as

an initial attempt to discover suitable variables for organised crime. However, as organised crime activities are extremely dynamic and fluid, future research should consider many more additional cases to ensure that the list of variables is complete and abreast with the latest trends in organised crime.

- Articulating an overarching framework for organised crime:

The definition of an overarching framework falls outside the scope of this project. As the focus is on articulating a novel model that could ultimately be used to define the overarching framework, it is foreseen that future efforts could leverage from this project to describe forthcoming overarching frameworks. These frameworks should articulate, as a minimum, the different sets of initiating circumstances associated with organised crime activities, classification of groups involved with these activities, the range of characteristics and actions related with organised crime groups, the various impacts experienced by communities, future trends and tendencies, combat strategies, and so forth.

- Automation of certain processes within the prototype environment:

As highlighted in section 8.7, the mechanism to execute the test case scenarios in OCIPS is fairly time consuming and intense. Future research projects should consider developing an evolutionary prototype that automates one or more of these processes. This should subsequently allow for more cases to be investigated, more accurately and in a shorter period of time.

- Testing of OCIPS on more substantive cases:

OCIPS has been tested on twelve test case scenarios only, due to the time consuming and tedious nature of the prototype. As a consequence, the findings cannot be generalised to organised crime as a whole in Australia and overseas, as the small sample size is statistically insufficient. In further projects, new evolutionary prototypes could enable researchers to test OCRM on hundreds of additional substantive cases and thereby confirming or challenging the findings in this research project.

- Testing of OCIPS in a real environment:

OCIPS has only been tested in an academic environment. Hence, the useability of OCRM for law enforcement officers and other crime investigators is still unknown. Therefore, future research projects should provide operational beta software products of OCIPS to allow law practitioners to further test and evaluate OCRM.

- Utilizing OCRM and OCIPS to articulating effective and innovative policies and strategies:

One of the long-term objectives of OCRM and OCIPS is to mature the model and prototype to such an extent that they could be used by the political sphere to fortify existing policies and strategies or to compile new, more effective and innovative policies and strategies. As OCRM and OCIPS are currently in their infancy stage, no direct attention was given to

devise how they could be applied to develop effective and innovative policies and strategies.

However, it is anticipated that OCRM and OCIPS could provide insightful information on economic opportunities embraced by organised crime syndicates, legislative constrains and antecedents of organised criminal activities that are normally addressed in effective policies and strategies. For this purpose, future projects could focus on methods and procedures that guide policymakers in the utilization of OCRM and OCIPS, especially in how to illuminate strategic information from historical crime cases in order to enhance the articulation of up-to-date policies and strategies.

The research project in its entirety was considered with the aim of listing the major caveats applicable to the thesis. Seven caveats were reflected upon, none of which is deemed as insurmountable to overcome in future research projects. For a matter of fact, it is anticipated that these caveats or limitations could lead to more research opportunities in the burgeoning field of organised crime.

9.5   Final Conclusion

It is a well-documented fact that organised crime has developed into a diverse, lethal, sophisticated and extremely complex phenomenon. Further to that, the occurrence of organised crime can be seen in most areas of society, i.e. private sector, public sector and governments world-wide; in some cases, it is extremely onerous to identify organised crime activities, due to the interweaving of these activities with legal and legitimate business processes. The adverse impact of this occurrence may result in certain communities or even countries being controlled by organised crime groups as a consequence of corruption, political turmoil and economic dependency on illicit markets. Although it appears that most governments do have the appetite and will to combat the phenomenon by articulating new policies and strategies, organised crime perpetrators continue to thrive financially. As a result, Murray (2013) asserts that law enforcement ought to develop and utilize innovative measures by identifying relevant options and opportunities to disrupt and dismantle organised crime syndicates.

The utilization of independent variables and network science, as articulated in this thesis, is a novice attempt to provide researchers and law practitioners with alternative options and opportunities to counteract organised crime. Furthermore, the cultivated model and prototype in chapters 7 and 8 have created the groundwork for developing evolving models and overarching frameworks in the future that could illuminate the intricacy of the phenomenon and thereby providing law enforcement with the much needed capability to proactively combating the sever criminality.

The initial results pertaining to the testing of OCRM by means of the prototype has created optimism that the model might be able to provide more in-depth understanding of the crime occurrence, as well as be able to contribute to the knowledge base of organised crime investigation. However, further piloting and evaluation of the model are suggested as part of future research projects.

In conclusion, it is envisaged that organised crime will become a bigger problem in the future and the impact of the crime will be more severe on governments, public sectors, communities and individuals. OCRM, as proposed in this thesis, has shown the potential to augment knowledge in the investigation of the phenomenon. Hence, the model in its current form or future iterations could make a substantial contribution in the fight against organised crime.

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Appendix A

The Five Steps Exploratory Approach:

A Low-Level Tabularisation of the Exploratory Process in terms of Organised Crime

A.1 <u>Prelude:</u>

This appendix augments the explanation of the five steps exploratory approach as outlined in chapter 4 and should be read in conjunction with section 4.5.

As highlighted in the chapter, various network science measures are available to characterise networks, such as organised crime. The measures extend from basic measurements that quantify the properties of nodes and edges to global measures that analyse the interconnectivity structure and statistical properties of the entire network. The five steps exploratory approach, as delineated in section 4.5, collates and explores the results of the various network measures in five sequential steps, thereby providing a high-level manifesto of procedures for applying network science to organised crime investigations.

Based on this manifesto, table A.1 summarizes the five steps exploratory approach by describing each step in terms of the applicable network measures. The table is logically segregated into five sub-tables, which is highlighted by different colours in the second column. Hence, each sub-table relates to each step in the exploratory approach. For each sub-table, the original twenty-eight selected independent variables, as articulated in chapter 3, are mapped to each step by epitomizing the appropriate nodes, relationships/edges, node/edge attributes, visualisation tools and so forth. Furthermore, each sub-table also includes typical inferences that can be drawn, based on the computed network measure/s. Section 4.6.3 exemplifies the application of these inferences on a real criminal network. Moreover, table A.1 is used as baseline to define the implementation strategy for OCRM in section 7.6 and evaluation of results obtained by OCIPS in sections 8.5 and 8.6.

Re f No .	Explorator y Approach Step	Variable	Node	Instance of Node	Relationshi p (link/edge)	Node/Edg e Attributes	Node/Edg e Matrixes	Local Matrixe s	Global Matrixes	Result Visualisation	Inference
1.	One	General	General	Person – Management Person - Soldier Person - User Special Events Operational Knowledge Skilled Profession (Military, Engineer, Professor, Politician, Lawyer, Law Enforcer) Location Organisation Task Motivation (Financial, Status or political) Tools (Mobile phones, electronic mail, etc.) Resources	All relationship s (Transactional, communicatio n, boundary penetration, instrumental, sentimental, authority/pow er and kinship.)	Importanc e, based on link frequency and relevance.	N/A	N/A	N/A	Applicable matrixes and/or graph/netwo rk layouts.	Low link frequency and relevance reflect **low initial importance**, whist high link frequency and relevance reflect **high initial importance**.
2.	One	Type of crime – Serious	Serious crime	Murder and Non-negligent	All relationship	Importanc e, based	N/A	N/A	N/A		

				Manslaughter.	s.	on link frequency and relevance.					
				Rape.							
				Robbery.							
				Aggravated Assault.							
				Burglary.							
				Larceny – Theft.							
				Arson.							
3.	One	Type of crime – Non-Serious	Non-Serious crime	Simple Assault.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Forgery and Counterfeiting.							
				Fraud.							
				Embezzlement.							
				Stolen Property.							
				Family Offences.							
				Sex Offences							
				Gambling.							
				Vandalism.							
4.	One	Weapon	Weapon	Firearm.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Knifes.							
				Blunt Object.							
				Personal Weapons.							
				Explosives.							
				Narcotics and Drugs.							
5.	One	Age	Age	0 to 18 years.	All	Importanc	N/A	N/A	N/A		

				19 to 30 years.	relationships.	e, based on link frequency and relevance.					
				31 to 45 years.							
				Older than 46 years.							
6.	One	Gender	Gender	Male.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Female.							
7.	One	Race	Race	White.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Black.							
				Asian.							
				Others.							
8.	One	IQ	IQ	IQ - Low	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				IQ - Medium							
				IQ - High							
				IQ - Unknown							
9.	One	Relationship of Victim to Offender	Relationship	Relationship – Family.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Relationship - Outside Family.							
				Relationship – Unknown.							
				Religion – Christian.							
				Religion – Catholic.							

				Religion – Others.							
10.	One	Differential Re-inforcement	Anticipated Rewards	Anticipated Rewards – Financial.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Anticipated Rewards - Status.							
				Anticipated Rewards – Others.							
			Anticipated Punishment	Anticipated Punishment – Community Release.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Anticipated Punishment – Imprisonment.							
				Anticipated Punishment – Suspended Sentence.							
				Anticipated Punishment – Others.							
11.	One	Definitions	Definitions	Attitude towards Law Enforcers – Positive.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Attitude towards Law Enforcers – Negative.							
				Attitude							

				towards Law Enforcers – Unknown.					
12.	One	Imitation	Imitation	Following protocol and terms – Yes.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A
				Following protocol and terms – No.					
				Following protocol and terms – Unknown.					
13.	One	Social Structure.	Social Structure.	Social Class – Proprietors.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A
				Social Class – Worker Class.					
				Social Class – Jobless.					
				Family Member of Crime Group - Yes.					
				Family Member of Crime Group - No.					
				Family Member of Crime Group - Unknown.					
				School Association with other Members –					

#												
					Yes.							
					School Association with other Members – No.							
					School Association with other Members – Unknown.							
14.		One	Attachment	Attachment	Openness to Comms - Low / Openness to Comms - Medium / Openness to Comms - High / Openness to Comms - Unknown / Fostering Relationships - Yes / Fostering Relationships – No. / Fostering Relationships – Unknown.	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
15.		One	Involvement	Involvement	Participating Sport – Yes / Participating Sport – No	All relationships.	Importance, based on link frequency	N/A	N/A	N/A		

				Participating Sport – Unknown		and relevance.					
				Participating Hobbies or Recreational Activities - Yes							
				Participating Hobbies or Recreational Activities – No							
				Participating Hobbies or Recreational Activities – Unknown							
				Participating in Close Relationship - Yes							
				Participating in Close Relationship – No							
				Participating in Close Relationship – Unknown							
16.	One	Informal Labels	Informal Labels	Behaviour as Appraised by Peers – Cooperative	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Behaviour as Appraised by							

			Peers – Troublesome						
			Behaviour as Appraised by Peers - Unknown						
			Attitude – Good						
			Attitude – Bad						
			Attitude – Unknown						
			Behaviour – Conforming						
			Behaviour – Deviant						
			Behaviour – Unknown						
			Behaviour – Obedient						
			Behaviour – Disobedient						
			Behaviour – Polite						
			Behaviour – Rude						
			Behaviour – Law-abiding						
17.	One	Goal Disappointment	Goal Disappointment	Failed Educational Aspirations – Yes	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A
				Failed Educational					

			Aspirations – No							
			Failed Educational Aspirations – Unknown							
			Employment of Choice – Successful							
			Employment of Choice – Unsuccessful							
			Employment of Choice - Unknown							
			Importance of High School Status – Yes							
			Importance of High School Status – No							
			Importance of High School Status – Unknown							
18.	One	Removal of Positive Stimuli	Removal of Positive Stimuli	Lost Friend or Family Member – Yes	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A	
				Lost Friend or Family Member – No						
				Lost Friend or Family Member -						

				Unknown							
19.	One	Exposure to Negative Stimuli	Exposure to Negative Stimuli	Is/was in Conflict with Parents and/or Peers – Yes	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				In/was in Conflict with Parents and/or Peers – No							
				Is/was in Conflict with Parents and/or Peers – Unknown							
				Expose to Child Abuse/Neglect – Yes							
				Expose to Child Abuse/Neglect – No							
				Expose to Child Abuse/Neglect – Unknown							
				Exposed to Verbal Threads and/or Insults – Yes							
				Exposed to Verbal							

				Threads and/or Insults – No					
				Exposed to Verbal Threads and/or Insults – Unknown					
20.	One	Family Structure Philosophy	Family Structure Philosophy	Family Risk Profile – Risk Taking	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A	
				Family Risk Profile – Risk Aversive						
				Family Risk Profile – Unknown						
21.	One	Capitalistic Economic System	Capitalistic Economic System	Economic Status – Powerful (one or more properties)	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A	
				Economic Status – Powerless (no properties)						
				Economic Status – Unknown						
22.	One	Family Culture	Family Culture	Family Culture – Strong Patriarchal	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A	
				Family Culture –						

				Strong Egalitarian Family Culture - Unknown					
23.	One	Roles	Roles	Roles – Management Roles – Soldier Roles – Protection Roles – Special Support Function Roles – Social Support Function Roles – End User	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A
24.	One	Status	Status	Status – High (high specific and high diffuse statuses) (Specific status refers to the ability of a member to actively contribute in activities. Diffuse status relates to state of	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A

#											
				wealth, occupation and race (white))							
				Status – Medium (high specific or high diffuse statuses)							
				Status – Low (both low specific and low diffuse statuses)							
25.	One	Official Communication Policy	Official Communication Policy	Communication Policy – Centralised	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Communication Policy – Decentralised							
				Communication Policy - Unknown							
26.	One	Degree of Autonomy	Degree of Autonomy	Degree of Autonomy – High (making decisions and control flow of information)	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Degree of Autonomy – Medium (limited part of decision							

				making and limited control in the flow of information)							
				Degree of Autonomy – Low (not part of decision making and has no control in the flow of information)							
27.	One	Social Support	Social Support	Social Support in Provisioning Resources – Yes	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Social Support in Provisioning Resources – No							
				Social Support in Provisioning Resources – Unknown							
28.	One	Resource	Resource	Resource Type – Money	All relationships.	Importance, based on link frequency and relevance.	N/A	N/A	N/A		
				Resource Type – Vehicle							
				Resource Type – People							

#											
				Resource Type – Properties							
				Resource Type – Tools							
				Resource Type – Others							
29.	Two	General	General	Person – Management Person - Soldier Person - User Special Events Operational Knowledge Skilled Profession (Military, Engineer, Professor, Politician, Lawyer, Law Enforcer) Location Organisation Task Motivation (Financial, Status or political) Tools (Mobile phones, electronic	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A	Applicable matrixes, tree layouts and/or graph/network layouts.	If degree of a node has a high numerical value it represents a node with a high-level of opportunity to influence others in the network. High in-degree denotes possible leader, while high out-degree highlights possible soldier. If power index has a high numerical value for a node, it indicates a powerful node. If Eignenvector Centrality for a node has a high numerical value it signifies that the

				mail, etc.)							node is very important, relevant
				Resources						and powerful in the network.
30.	Two	Type of crime – Serious	Serious crime	Murder and Non-Negligent Manslaughter.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A	If closeness centrality for a node has a high numerical value then it represents a node with high indirect influences, thus high intermediary power.
				Rape.						
				Robbery.						
				Aggravated Assault.						
				Burglary.						
				Larceny – Theft.						If betweenness centrality for a node has a high numerical value then it indicates that the node has a high directed influence in the network.
				Arson.						
31.	Two	Type of crime – Non-Serious	Non-Serious crime	Simple Assault.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3)	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node	N/A	If cluster coefficient of a node has a high numerical value (close to 1) it indicates that the node has a high cohesiveness
				Forgery and Counterfeiting.						
				Fraud.						
				Embezzlement.						
				Stolen						

No.		Node	Node	Categories	Relationships		Network Measurements	Node Measurements			Description
				Property. Family Offences. Sex Offences Gambling. Vandalism.			Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			among other nodes. If the average cluster coefficient of the network has a high numerical value (close to 1) it represents high cohesiveness among nodes, as well as regular lattice graph shape layout. Conversely, low value denotes random graph shape layout.
32.	Two	Weapon	Weapon	Firearm. Knifes. Blunt Object. Personal Weapons. Explosives. Narcotics and Drugs.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node	N/A		If boundary spanner measurement has a high numerical value for a node, it indicates the possible bridging functionality of the node. If hub measurement for a node has a high numerical value it signifies that the
							ss	Node			

#											
							Centrality = Numerical Value	Basis) = Numerical Value			node has a high-level of control in the network, therefore this node determines the effectiveness of the network.
33.	Two	Age	Age	0 to 18 years. 19 to 30 years. 31 to 45 years. Older than 46 years.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A		If authority measurement for a node has a high numerical value then it represents that the node has a high-level of control in the network, therefore this node determines the effectiveness of the network.

A high entropy value indicates more randomness and less structure in the graph, resulting in greater variability and more uncertainty in terms of the structure, while low entropy value |
| 34. | Two | Gender | Gender | Male. Female. | All relationships. | N/A | 1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) | 1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node | N/A | | |

No.											
							Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			(closer to 0) denotes less randomness and a more structural graph. The degree sequence distribution highlights the 'shape' of a graph and entropy points out the regularity or lack of it in the
35.	Two	Race	Race	White. Black. Asian. Others.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness ss	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node	N/A		shape. Therefore, the more regular the shape of a graph, the less randomness and the less entropy there is in a graph. At one extreme, regular graphs have very little entropy and at the other extreme, random graphs have very little regularity. **Important outcomes:** Above measures determine the size

No.		Col3	Col4	Values	Rel	N/A	Node Metrics	Node-by-Node Metrics	N/A	Narrative
							Centrality = Numerical Value	Basis) = Numerical Value		of the network, overall betweenness of nodes in ranked order, overall closeness of nodes in ranked order, overall influence of each node in ranked order and overall power of each node in table format.
36.	Two	IQ	IQ	IQ - Low IQ - Medium IQ - High IQ - Unknown	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eigenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A	A list of nodes and links not active in the data set, including an explanation of the significance thereof.
37.	Two	Relationship of Victim to Offender	Relationship	Relationship – Family. Relationship - Outside Family. Relationship – Unknown. Religion – Christian.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3)	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node	N/A	

#									
				Religion – Catholic. Religion – Others.			1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	
38.	Two	Differential Re-inforcement	Anticipated Rewards	Anticipated Rewards – Financial. Anticipated Rewards - Status. Anticipated Rewards – Others.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node	N/A

#										
							Centrality = Numerical Value	Basis) = Numerical Value		
			Anticipated Punishment	Anticipated Punishment – Community Release. Anticipated Punishment – Imprisonment. Anticipated Punishment – Suspended Sentence. Anticipated Punishment – Others.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A	
39.	Two	Definitions	Definitions	Attitude towards Law Enforcers – Positive. Attitude towards Law Enforcers – Negative. Attitude	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3)	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node	N/A	

				towards Law Enforcers – Unknown.			Eignenvect or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne ss Centrality = Numerical Value	Basis) = Numerica l Value 3) Hub (Node by Node Basis) = Numerica l Value 4) Authority (Node by Node Basis) = Numerica l Value			
40.	Two	Imitation	Imitation	Following protocol and terms – Yes. Following protocol and terms – No. Following protocol and terms – Unknown.	All relationship s.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvect or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne ss	1) Cluster Coefficie nt = Numerica l Value 2) Boundary Spanner (Node by Node Basis) = Numerica l Value 3) Hub (Node by Node Basis) = Numerica l Value 4) Authority (Node by Node	N/A		

							Centrality = Numerical Value	Basis) = Numerical Value			
41.	Two	Social Structure.	Social Structure.	Social Class – Proprietors.	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A		
				Social Class – Worker Class.							
				Social Class – Jobless.							
				Family Member of Crime Group - Yes.							
				Family Member of Crime Group - No.							
				Family Member of Crime Group - Unknown.							
				School Association with other Members – Yes.							
				School Association with other Members – No.							
				School Association with other Members –							

				Unknown.							
42.	Two	Attachment	Attachment	Openness to Comms - Low	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A		
				Openness to Comms - Medium							
				Openness to Comms - High							
				Openness to Comms - Unknown							
				Fostering Relationships - Yes							
				Fostering Relationships – No.							
				Fostering Relationships – Unknown.							
43.	Two	Involvement	Involvement	Participating Sport – Yes	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvect	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) =	N/A		
				Participating Sport – No							
				Participating Sport – Unknown							
				Participating Hobbies or Recreational							

				Activities - Yes			or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			
				Participating Hobbies or Recreational Activities – No							
				Participating Hobbies or Recreational Activities – Unknown							
				Participating in Close Relationship - Yes							
				Participating in Close Relationship – No							
				Participating in Close Relationship - Unknown							
44.	Two	Informal Labels	Informal Labels	Behaviour as Appraised by Peers – Cooperative	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector or Centrality =	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value	N/A		
				Behaviour as Appraised by Peers – Troublesome							
				Behaviour as Appraised by Peers - Unknown							

#										
				Attitude – Good			Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value		
				Attitude – Bad						
				Attitude – Unknown						
				Behaviour – Conforming						
				Behaviour – Deviant						
				Behaviour – Unknown						
				Behaviour – Obedient						
				Behaviour – Disobedient						
				Behaviour – Polite						
				Behaviour – Rude						
				Behaviour – Law-abiding						
45.	Two	Goal Disappointment	Goal Disappointment	Failed Educational Aspirations – Yes	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality =	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value	N/A	
				Failed Educational Aspirations – No						
				Failed Educational Aspirations – Unknown						

				Employment of Choice – Successful			Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			
				Employment of Choice – Unsuccessful							
				Employment of Choice - Unknown							
				Importance of High School Status – Yes							
				Importance of High School Status – No							
				Importance of High School Status – Unknown							
46.	Two	Removal of Positive Stimuli	Removal of Positive Stimuli	Lost Friend or Family Member – Yes	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality =	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerica	N/A		
				Lost Friend or Family Member – No							
				Lost Friend or Family Member - Unknown							

#											
							Numerical Value 5) Betweenne ss Centrality = Numerical Value	l Value 4) Authority (Node by Node Basis) = Numerica l Value			
47.	Two	Exposure to Negative Stimuli	Exposure to Negative Stimuli	Is/was in Conflict with Parents and/or Peers – Yes	All relationship s.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvect or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne ss Centrality = Numerical Value	1) Cluster Coefficie nt = Numerica l Value 2) Boundary Spanner (Node by Node Basis) = Numerica l Value 3) Hub (Node by Node Basis) = Numerica l Value 4) Authority (Node by Node Basis) = Numerica l Value	N/A		
				In/was in Conflict with Parents and/or Peers – No							
				Is/was in Conflict with Parents and/or Peers – Unknown							
				Expose to Child Abuse/Neglec t – Yes							
				Expose to Child Abuse/Neglec t – No							
				Expose to Child Abuse/Neglec t – Unknown							

#											
				Exposed to Verbal Threads and/or Insults – Yes							
				Exposed to Verbal Threads and/or Insults – No							
				Exposed to Verbal Threads and/or Insults – Unknown							
48.	Two	Family Structure Philosophy	Family Structure Philosophy	Family Risk Profile – Risk Taking	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by	N/A		
				Family Risk Profile – Risk Aversive							
				Family Risk Profile – Unknown							

#	Two										
							ss Centrality = Numerical Value	Node Basis) = Numerical Value			
49.	Two	Capitalistic Economic System	Capitalistic Economic System	Economic Status – Powerful (one or more properties) Economic Status – Powerless (no properties) Economic Status – Unknown	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	N/A		
50.	Two	Family Culture	Family Culture	Family Culture – Strong Patriarchal Family Culture – Strong Egalitarian	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner	N/A		

#	Type			Entities	Relationships		Metrics	Metrics	
				Family Culture - Unknown			Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	(Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value	
51.	Two	Roles	Roles	Roles – Management Roles – Soldier Roles – Protection Roles – Special Support Function Roles – Social Support Function Roles – End User	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5)	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority	N/A

#											
							Betweenne ss Centrality = Numerical Value	(Node by Node Basis) = Numerica l Value			
52.	Two	Status	Status	Status – High (high specific and high diffuse statuses) (Specific status refers to the ability of a member to actively contribute in activities. Diffuse status relates to state of wealth, occupation and race (white))	All relationship s.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvect or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne ss Centrality = Numerical Value	1) Cluster Coefficie nt = Numerica l Value 2) Boundary Spanner (Node by Node Basis) = Numerica l Value 3) Hub (Node by Node Basis) = Numerica l Value 4) Authority (Node by Node Basis) = Numerica l Value	N/A		
				Status – Medium (high specific or high diffuse statuses)							
				Status – Low (both low specific and low diffuse statuses)							
53.	Two	Official	Official	Communicati	All	N/A	1) The	1) Cluster	N/A		

#											
		Communication Policy	Communication Policy	on Policy – Centralised	relationships.		Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			
				Communication Policy – Decentralised							
				Communication Policy - Unknown							
54.	Two	Degree of Autonomy	Degree of Autonomy	Degree of Autonomy – High (making decisions and control flow of information)	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality =	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value	N/A		
				Degree of Autonomy – Medium (limited part of decision							

#											
				making and limited control in the flow of information)			Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality = Numerical Value	3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) = Numerical Value			
				Degree of Autonomy – Low (not part of decision making and has no control in the flow of information)							
55.	Two	Social Support	Social Support	Social Support in Provisioning Resources – Yes	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvector Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenness Centrality =	1) Cluster Coefficient = Numerical Value 2) Boundary Spanner (Node by Node Basis) = Numerical Value 3) Hub (Node by Node Basis) = Numerical Value 4) Authority (Node by Node Basis) =	N/A		
				Social Support in Provisioning Resources – No							
				Social Support in Provisioning Resources – Unknown							

No.									
							Numerical Value	Numerica l Value	
56.	Two	Resource	Resource	Resource Type – Money Resource Type – Vehicle Resource Type – People Resource Type – Properties Resource Type – Tools Resource Type – Others	All relationships.	N/A	1) The Degree of a Node = Numerical Value 2) Power Index = Numerical Value 3) Eignenvect or Centrality = Numerical Value 4) Closeness Centrality = Numerical Value 5) Betweenne ss Centrality = Numerical Value	1) Cluster Coefficie nt = Numerica l Value 2) Boundary Spanner (Node by Node Basis) = Numerica l Value 3) Hub (Node by Node Basis) = Numerica l Value 4) Authority (Node by Node Basis) = Numerica l Value	N/A
57.	Two	-	-	-	All relationship s	N/A	N/A	N/A	1) Graph Entropy = Numerical Value 2) Average Degree Centrality = Numerical Value 3) Average Closeness

								Centrality = Numerical Value 4) Average Betweenness Centrality = Numerical Value 5) Average Eigenvector Centrality = Numerical Value 6) Node Degree distribution = Distribution Type 7) Degree Correlation Function = Numerical Value 8) Node Betweenness Distribution = Numerical Value 9) Average Cluster Coefficient = Numerical Value 10) Average		

								Path Length = Numerical Value		
58.	Three	N/A	N/A	N/A	All relationships	Statistical measurements for comparing and contrasting of the 28 Independent Variables: 1. Mean of overall In-degree = Numerical Value. 2. Mean of overall Out-degree = Numerical Value. 3. Mean of overall Closeness Centrality = Numerical Value. 4. Mean of overall Betweenness Centrality = Numerical Value. 5. Standard Deviation of overall In-degree = Numerical Value. 6. Standard Deviation of overall Out-degree = Numerical Value. 7. Standard Deviation of overall Closeness Centrality = Numerical Value. 8. Standard Deviation of overall Betweenness Centrality = Numerical Value. 9. Sum Total of overall In-degree = Numerical Value. 10. Sum Total of overall Out-degree = Numerical Value. 11. Sum Total of overall Closeness Centrality = Numerical Value. 12. Sum Total of overall Betweenness Centrality = Numerical Value. 13. Minimum In-degree = Numerical Value. 14. Minimum Out-degree = Numerical Value. 15. Minimum Closeness Centrality = Numerical Value. 16. Minimum Betweenness Centrality =	1) Connection Matrix 2) Adjacent Matrix 3) Laplacian Matrix 4) Path Matrix 5) Tree Layout 6) Network Layout	Identification of possible cliques, boundary spanners, hubs, authorities, adopters, diffusors, influential individuals and opinion leaders in terms of the 28 variables. See sections 4.2 and 4.3 for further information. The mean In-degree and Out-degree values highlight whether or not the network is symmetric, or not. A high standard deviation for In-degree and Out-degree signify large difference between the

					Numerical Value. 17. Maximum In-degree = Numerical Value. 18. Maximum Out-degree = Numerical Value. 19. Maximum Closeness Centrality = Numerical Value. 20. Maximum Betweenness Centrality = Numerical Value. <u>General measures for comparing and contrasting pertaining to the independent variables:</u> 21. Average Path Distance among all nodes in Network = Numerical Value. 22. Heterogeneity of Members in Network = Numerical Value. 23. Network Centralisation (In and Out-degree) = Numerical Value. 24. No. of Core Nodes = Numerical Value. 25. No. of Peripheral Nodes = Numerical Value. 26. Density of Entire Network = Numerical Value. 27. Density of Core Network = Numerical Value. 28. Density of Peripheral Network = Numerical Value. 29. Total No. of Relationships in Network = Numerical Value. 30. No. of Relationships in Core Network = Numerical Value. 31. No. of Relationships in Peripheral Network = Numerical Value. 32. Average Path Distance between Core Nodes = Numerical Value. 33. Average Path Distance between Peripheral Nodes = Numerical Value. 34. No. of Cliques = Numerical Value. 35. No. of Boundary Spanners = Numerical Value.	numbers of relationships that each node has (e.g. core nodes have significant more relationships compared to peripheral nodes). A few nodes with high Out-degree and In-degree network centralisation measures indicate significant centralisation around a few important nodes, thus a centralised network structure. Average degree centrality - The lower the amount of connections between nodes in comparison with the total number of

					36. No. of Hubs = Numerical Value. 37. No. of Authorities = Numerical Value. 38. No. of Adopters = Numerical Value. 39. No. of Diffusors = Numerical Value. 40. No. of Influential Individuals = Numerical Value. 41. No. of Opinion Leaders = Numerical Value.		connections, the more fragmented the network. Low number of connections are common for illegal networks. Mean overall betweenness centrality – The higher the value of the measurement, the greater the level of control and the less the effectiveness of the network. Mean overall closeness centrality – The higher the value, the closer the nodes are to one another and the more effective the network. A high value could indicate that the network is susceptive to influences from

							the outside.
							Path distance (length) determines the safety and secrecy of illegal networks. Short path distance leads to easy detection of other nodes.

Prestige – The higher the status of the node in the society and the more control the member has in the network (that is, high node closeness centrality compared against overall closeness centrality), the more important is the member and the higher the prestige of that member.

Identification of possible future |

								relationships by applying the transitivity concept. Identification of influence of each node based on betweenness, closeness and proximity concepts – For example, high betweenness, closeness and relationship with core members will depict highly influential members.
59.	Four	N/A	N/A	N/A	All relationships	Population segregation into small connected communities: 1. Remove the Hub and/or Authority Independent Variable Nodes from the network. 2. Thereafter, the statistical community matrixes are compared with statistical community matrixes of other communities, individual nodes and links/edges within the community, as well as the statistical matrixes of the entire network.	1) Segregated Network Layout	Creation of a low-level layout or network structure of the organisation under investigation in terms of the 28 independent variables. The identification of communities that coexist in the network with

						similar or different characteristics related to the independent variables.		
60.	Five	N/A	N/A	N/A	All relationships	Comprehend the synchronisation evolution of the network by repeating foregoing steps one to four a number of times for each data set.	1) Connection Matrix 2) Adjacent Matrix 3) Laplacian Matrix 4) Path Matrix 5) Tree Layouts 6) Network Layouts	Identification of the core nodes/independent variables and relationships as the network developed over time. Recognition of the emergent leaders in terms of the management and soldiers over time. Identification of the type of crime or delinquency offended over time. Exhibition of the movement of nodes over time in relation to the 28 independent variables. Recognition of the workload of

							management and soldiers. Identification of destabilisation actions. Compilation of the evolvement of the network over time in terms of organisation charts and network layouts.

Table A.1: A Summary of the Five Steps Exploratory Approach.

Appendix B

Organised Crime Case Study Research:

Inter-rater Reliability

B.1 <u>Prelude:</u>

In chapter 5, four research questions were defined, which need to be addressed within the research project. Three of the four objectives relate directly to the investigation and reconnaissance building of organised crime cases. The three research objectives referred to are as follows:

- What are the critical attributes (independent variables) necessary for investigating nodes and relationships of organised criminal groups and activities?" (Research question 1);
- Which theory or approach to behaviourism best explains and predicts individual and groups behaviour of those involved in organised crime? (Research question 2); and
- Do criminals follow a general methodology while conducting organised crime and can it be used to investigate future criminal cases? (Research question 3).

In relation to the three objectives, chapter 2 has focused on the most important aspects of organised crime, and concluded with a new holistic taxonomy of organised crime. Chapter 3 then used the taxonomy as a premise to identify suitable attributes or independent variables to exhibit organised crime in a more understandable and vivid manner. Before operationalizing the independent variables by applying them to randomly selected substantive cases, and thereby attempting to answer above research questions, it is imperative to establish the inter-rater reliability.

This appendix predominantly focuses on the coding schedule for one of the eleven cases conducted by both the researcher and research assistant, in order to establish the inter-rater reliability. For more information on the coding schedule results for the remaining ten selected cases, as well as a discussion on the content of each case in terms of the above three research objectives, contact the author of this thesis.

B.2   Coding Reliability Testing:

This section relates to the inter-rater reliability testing, which aims to measure the agreement among the researcher and research assistance in terms of context analysis of a selected criminal case. The case referred to is R v Offender A. The coding of the case was performed autonomously by the two coders and the results are listed in tables B.2.1 and B.2.2. For further explanation regarding the outcome of the test, please see sections 6.2 and 6.3.

Ref No.	Variable Description		Result
	Variable 1 - General		
1.1	How many offenders or alleged offenders are listed in the case study?		2
1.2	For each offender or alleged offender, please categories their role in the organisation.		
	Select one of the following types of roles: 1 for Management, 2 for Soldier (worker in organised crime group), 3 for User of illicit goods or 4 for unknown.	Offender A	1 - Management & 2 - Soldier.
		Offender B	2 - Soldier.
1.3	What is the relationship between the different offenders or alleged offenders?		
	Select one of the following relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) or 8 for Unknown.	Offender A and Offender B	5 - Sentimental (Partners).
1.4	Are there any special events documented in the case study?		
	Select one of the following: 1 for No special event, 2 for Meetings, 3 for Marriage, 4 for Family gatherings, 5 for Funerals or 6 for Unknown.		1 - No Special Event.
1.5	Identify the persons with skilled professions in the case study.		
	Select one of the following: 1 for Military skills, 2 for Engineering skills, 3 for Higher education skills (Professor), 4 for Political skills, 5 for Lawyer skills, 6 for Law enforcement skills, 7 for Accounting skills or 8 for Unknown.		None.
1.6	Where was the crime committed?		
	Select one of the following: 1 for WA, 2 for SA, 3 for NSW, 4 for ACT, 5 for NT, 6 for QLD, 7 for Oversees or 8 for Unknown.		3 - NSW.
1.7	Select the main organisational task for each role player in the case study.		
	Select one of the following: 1 Criminal activity within group, 2 for Protecting the group, 3 for Specialised support (e.g. manage resources), 4 for User support, 5 for Social support (members of group who are also business leaders), 6 for Others or 7 for Unknown.	Offender A	1 - Criminal Activity.
		Offender B	1 - Criminal Activity.
1.8	Based on the narrative of the case study, what would you identify as the motive for the offence/s or alleged offence/s.		
	Select one of the following: 1 for Financial benefits, 2 for Status benefits, 3 for Political gain, 4 for Others or 5 for Unknown.		1 - Financial Benefits.

1.9	Which tools are listed in the case study that was used as the conduit through which the offenders or alleged offenders conducted the crime?			
	Select one of the following: 1 for Computers, 2 for Mobile phones, 3 for E-mails via computer or Phones, 4 for Electronic Social Media via computer or phones, 5 for Others or 6 for Unknown.			2 - Mobile Phones & 3 - Computers.
1.10	Which resources were exerted by the respective offenders or alleged offenders?			
	Select one of the following: 1 for Capital funds, 2 for Vehicles, 3 for People, 4 for Weapons, 5 for Electronic tools, 6 for Others or 7 for Unknown.		Offender A	5 - Electronic Tools (Bank Accounts & other Personal Identity).
			Offender B	5 - Electronic Tools (Bank Accounts & other Personal Identity).
1.11	How many witnesses are listed in the case study?			
				2
			Witness A	Voice Comparison Expert.
			Witness B	Voice Expert.
1.12	What is the relationship between the different witnesses and offenders?			
	Select one of the following relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) 8 for No relationship or 9 for Unknown.		Witness A and Offender A	8 - No Relationship.
			Witness A and Offender B	5 - Sentimental (Friendship).
			Witness B and Offender A	8 - No Relationship.
			Witness B and Offender B	8 - No Relationship.
1.13	How many victims are listed in the case study?			21 victims
			Victims	Unknown.
	Variable 2 - Type of Crime – Serious			
2	Which type of serious crime/s was committed by the offenders or alleged offenders?			
	Select one of the following: 1 for Murder and Non-Negligent Manslaughter, 2 for Rape, 3 for Robbery, 4 for Aggravated Assault, 5 for Burglary, 6 for Theft, 7 for Arson, 8 for Drug Offences Serious, 9 for Planning, Organising and Engaging in serious crime activities, 10 for Unknown or 11 for Not Applicable.		Offender A	N/A.
			Offender B	N/A.
	Variable 3 - Type of Crime - Non-Serious			
3	Which type of non-serious crime/s was committed by the offenders or alleged offenders?			

	Select one of the following: 1 for Simple Assault, 2 for Forgery, 3 for Counterfeiting, 4 for Fraud, 5 for Embezzlement, 6 for Stolen Property, 7 for Family Offences, 8 for Sex Offences, 9 for Gambling, 10 for Vandalism, 11 for Drug Offences Non-Serious, 12 for Human Trafficking, 13 for Unknown or 14 for Not Applicable.	Offender A	4 - Fraud (Contrary to 400.4(1) of the Criminal Code (Cth)).
		Offender B	4 - Fraud (Contrary to 400.4(1) of the Criminal Code (Cth)).
	Variable 4 – Weapon		
4	Which type of weapon was used by the offender or alleged offender to commit the crime?		
	Select one of the following: 1 for Firearm, 2 for Knifes, 3 for Blunt Object, 4 for Personal Weapons, 5 for Explosives, 6 for Narcotics and Drugs, 7 for Unknown or 8 for Others.	Offender A	8 - (Bank Accounts & other Personal Identity).
		Offender B	8 - (Bank Accounts & other Personal Identity).
	Variable 5 – Age		
5	What is the age group for each offender or alleged offender?		
	Select one of the following: 1 for 0 to 18 years, 2 for 19 to 30 years, 3 for 31 to 45 years, 4 for older than 46 years or 5 for Unknown.	Offender A	3 -33 Years of Age.
		Offender B	5 - Unknown.
	Variable 6 – Gender		
6	Based on the description in the case study, could you identify the gender of the offenders or alleged offenders?	Offender A	2 - Female.
	Select one of the following: 1 for Male, 2 for Female or 3 for Unknown.	Offender B	1 - Male.
	Variable 7 – Race		
7	What is the ethnical background of the offender or alleged offender?	Offender A	3 - Asian.
	Select one of the following: 1 for White, 2 for Black, 3 for Asian, 4 for Others or 5 for Unknown.	Offender B	5 - Unknown.
	Variable 8 – IQ		
8	Based on the description in the case study, how will you describe the intelligence quotient (IQ) of the offenders or alleged offenders?	Offender A	2 - Medium.
	Select one of the following: 1 for Low, 2 for Medium, 3 for High or 4 for Unknown.	Offender B	2 - Medium.
	Variable 9 - Relationship of Victim to Offender		
9	What is the relationship between the offender and victim?	Offender A	2 - Outside Family.
	Select one of the following: 1 for Family, 2 for Outside Family or 3 for Unknown.	Offender B	2 - Outside Family.
	Variable 10 - Differential Reinforcement		
10.1	Differential reinforcement in a nutshell refers to the balance of anticipated or actual rewards and punishments that result after completion of a certain act or behaviour. According to this description,	Offender A	1 - Financial Rewards.

	what was the anticipated reward for each of the offenders or alleged offenders?		
	Select one of following: 1 for Financial Rewards, 2 for Status Rewards, 3 Other Rewards or 4 for Unknown.	Offender B	1 - Financial Rewards.
10.2	Also, based on the previous definition, what was the anticipated punishment for each of the offenders or alleged offenders?		
	Select one of the following: 1 for Community Release, 2 for Imprisonment, 3 for Suspended Sentence, 4 for Other Punishment or 5 for Unknown.	Offender A	3 - Suspended Sentence.
		Offender B	5 - Unknown.
	Variable 11 – Definitions		
11	Definitions relate to the attitudes or meanings that individuals attach to a given behaviour. Based on the given definition, what attitude towards law enforcers did the offenders or alleged offenders exhibited.	Offender A	2 - Negative Attitude. (Pleaded not-guilty.)
	Select one of the following: 1 for Positive Attitudes, 2 for Negative Attitudes or 3 for Unknown.	Offender B	1 - Positive Attitude (Pleaded guilty.
	Variable 12 – Imitation		
12	Imitation is defined as the engagement in behaviour after the observation of similar behaviour in others. Based on the description of the definition and the content in the case study, do the offenders or alleged offenders follow protocol and terms of the organised crime organisation?	Offender A	1 - Yes.
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	1 - Yes.
	Variable 13 - Social Structure		
13.1	Social structures and the behaviour of individuals all contribute to the general learning for individuals. As a consequence, which social class best representing each offender or alleged offender?	Offender A	4 - Unknown.
	Select one of the following: 1 for Proprietors, 2 for Worker Class, 3 for Jobless or 4 for Unknown.	Offender B	4 - Unknown.
13.2	Do any of the offenders or alleged offenders have family members or acquaintances that are part of the organised crime group or any other crime syndicate?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1 - Yes.
		Offender B	1 - Yes.
13.3	Do any of the offenders or alleged offenders have school association with other members of the organised crime group or any other crime syndicate?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	3 - Unknown.
		Offender B	3 - Unknown.
	Variable 14 – Attachment		
14.1	Attachment to others is seen as a strong indicator of the future behaviour of individuals. Openness to communicate with others is an important element of bonding to others. Therefore, based on the evidence in the case study, does each offender or alleged offender exhibit openness to communicate with others?	Offender A	4 - Unknown.
	Select one of the following: 1 for Low Openness, 2 for Medium Openness, 3 for High Openness or 4 for Unknown.	Offender B	4 - Unknown.

14.2	Do the offenders or alleged offenders display any signs of affection or fostering relationships with others members in the organisation or other crime groups?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1 - Yes.
		Offender B	1 - Yes.
	Variable 15 – Involvement		
15.1	The involvement variable relates to a person's obsession in conventional activities, such as studying, spending time with family and participation in extra-curricular activities. From the background data in the case study, is there any evidence of participation of sport activities by offenders or alleged offenders.	Offender A	2 - No.
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2 - No.
15.2	Is there any evidence in the case study of participation of hobby or recreational activities by offenders or alleged offenders?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	2 - No.
		Offender B	2 - No.
15.3	Is there any evidence in the case study that indicates close relationships by offenders or alleged offenders?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1 - Yes (Deteriorating relationship with her partner.)
		Offender B	1 - Yes.
	Variable 16 - Informal Label		
16.1	Labels in general associated with individuals may affect their self-identity and could transform them so that they see themselves in the light of the label or self-fulfilling prophecy. Furthermore, informal labels imitate labels produced by parents, teachers and peers with respect to individuals. Based on the content of the case study, how did the peers appraise the offenders or alleged offenders?	Offender A	3 - Unknown.
	Select one of the following: 1 for Cooperative, 2 for Troublesome or 3 for Unknown.	Offender B	3 - Unknown.
16.2	Based on the content of the case study, how did the parents, teachers or peers rate the attitude of each offender or alleged offender?		
	Select one of the following: 1 for Good, 2 for Bad or 3 for Unknown.	Offender A	3 - Unknown.
		Offender B	3 - Unknown.
16.3	Based on the content of the case study, how did the parents, teachers or peers rate the behaviour of each offender or alleged offender?		
	Select one of the following: 1 for Conforming, 2 for Deviant, 3 for Obedient, 4 for Polite, 5 for Rude, 6 for Law-abiding or 7 for Unknown.	Offender A	7 - Unknown.
		Offender B	7 - Unknown.
	Variable 17 - Goal Disappointment		
17.1	Goals pertaining to this variable encompass immediate, ideal and future goals. Examples of such goals can include adequate education, employment/occupation, dwellings and so forth. Based on the information in the case study, could you establish any failed educational aspirations for each offender or alleged offender?	Offender A	1 - Yes.

	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2 - No.
17.2	Based on the information in the case study, do you believe the offender or alleged offender has established employment of personal choice?		
	Select one of the following: 1 for Successful (has established employment of personal choice), 2 for Unsuccessful or 3 for Unknown.	Offender A	2 - Unsuccessful.
		Offender B	3 - Unknown.
17.3	Based on the information in the case study, do you believe the offender or alleged offender has valued the importance of high school status?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	3 - Unknown.
		Offender B	3 - Unknown.
	Variable 18 - Removal of Positive Stimuli		
18	Removal of positive or desired stimuli from an individual relates to the experience of an individual with stressful events that can lead to anomic feelings. Examples of this situation include the loss of a friend, serious illness, death of a friend or family member, separation of parents, and so forth. By analysing the case study, is there any evidence that indicate the loss of a friend or family member for each of the offenders or alleged offenders?	Offender A	1 - Yes (The deteriorating relationship with her partner and the removal of her three children into foster care.)
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	3 - Unknown.
	Variable 19 - Exposure to Negative Stimuli		
19.1	Negative stimuli variable refers to certain stressful life events that involve the confrontation of individuals with negative actions by others. Such stressful events include child abuse or neglect, criminal victimisation, verbal threats and insults, and negative relations with parents and peers. According to the contents of the case study, is there any evidence suggesting that the offender or alleged offender is/was in conflict with his/her parents and/or peers?	Offender A	2 - No (Resided with Parents.)
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2 - No.
19.2	Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to child abuse?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	2 - No.
		Offender B	2 - No.
19.3	Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to verbal threads?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1 - Yes (Violence in the relationship.)
		Offender B	2 - No.
	Variable 20 - Family Structure Philosophy		
20	The family structure variable shapes the social reproduction of gender relations and as a consequence the social distribution of delinquencies. Typical values for this variable could include family controls that promote risk taking (investing in properties, holidaying in high risk countries, friendship with convicted criminals or alleged criminals, etc.) or risk aversive. Based on the background information in the case study, is there any evidence that describe the family risk profile for each offender or alleged offender?	Offender A	3 - Unknown.
	Select one of the following: 1 for Risk Taking, 2 for Risk Aversive or 3 for Unknown.	Offender B	3 - Unknown.

		Variable 21 - Capitalistic Economic System		
21		A Capitalist Economic System is one characterised by free markets and the absence of government intervention in the economy. Private individuals or corporations who have the means of production, distribution, and exchange of wealth are classified as the powerful class of the society. (In many cases, they will own one or more properties and/or businesses). To the contrary, the powerless class of society own no properties or businesses. From the contents of the case study, which economic social class would you label each offender or alleged offender?	Offender A	1 - Powerful Class.
		Select one of the following: 1 for Powerful Class, 2 for Powerless Class or 3 for Unknown.	Offender B	1 - Powerful Class.
		Variable 22 - Family Culture		
22		The family culture variable is described either as strong Patriarchal or strong Egalitarian. Patriarchal culture is marked by the supremacy of the father in the family, the legal dependence of wives and children, and the reckoning of descent and inheritance in the male line; broadly control by men of a disproportionately large share of power. Egalitarian culture on the other hand represents a belief in human equality especially with respect to social, political, and economic affairs. Based on these two definitions and evidence in the case study, how would you classify the family culture of the offenders or alleged offenders?	Offender A	3 - Unknown.
		Select one of the following: 1 for Strong Patriarchal, 2 for Strong Egalitarian or 3 for Unknown.	Offender B	3 - Unknown.
		Variable 23 – Roles		
23		Please see questions 1.2 and 1.7.		
		Variable 24 – Status		
24		Status hierarchies in groups are dynamic and can vary over time. In this context, status stems from two separate sets of characteristics, namely, specific status characteristics and diffuse status characteristics. Specific status characteristics refer to attributes that relate directly to the ability of the member of the group to perform his or her task, e.g. being a loyal and hard worker. Diffuse status characteristics on the other hand refer to attributes that do not relate directly to the ability of the member to perform his or her task, but rather refer to the member's status in the society, e.g. being wealthy. The overall status of each member of a group is determined by the sum total of both specific and diffuse statuses. By taking last mentioned into consideration, how would you rate the status of each offender or alleged offender in the case?	Offender A	3 - Low Status.
		Select one of the following: 1 for High Status, 2 for Medium Status, 3 for Low Status or 4 for Unknown.	Offender B	4 - Unknown.
		Variable 25 - Official Communication Policy		
25.1		Communication networks range from highly centralised to highly decentralise. In centralised communication networks, one or a few members control the flow of information throughout the network. In decentralised communication network, communication among members is unregulated and in some cases, communication is limited to smaller decentralised parts of the network. According to the content of the case study, how would you classify the communication network of the criminal or alleged criminal group?		3 - Unknown.

	Select one of the following: 1 for Centralised, 2 for Decentralised, 3 for Unknown.		
25.2	Which communication method was used by the offenders or alleged offenders to communicate within and outside the group?	Offender A	1 - In person and 2 - Mobile.
	Select one or more of the following: 1 for Verbal-in-person, 2 for Verbal thru Electronic Media (mobile), 3 for Written-on-paper, 4 for Written thru Electronic Mail, 5 for Written thru Social Networks or 6 for Unknown.	Offender B	1 - In person and 2 - Mobile.
	Variable 26 - Degree of Autonomy		
26	The degree of autonomy variable refers to the ability of the offender or alleged offender to make decision without consulting others, controlling the flow of information and performing general tasks within the crime group or syndicate without having to request permission and report progress with regular intervals. Research has pointed out that in a centralised communication structure, the hub or core members have normally more power, less restricted and fully independent compared to the peripheral members. In a decentralised communication network, all members normally experience a high level of autonomy. By analysing the case study, how would you rate the degree of autonomy pertaining to each offender or alleged offender?	Offender A	1 - High Degree of Autonomy.
	Select one of the following: 1 for High Degree of Autonomy (making decisions and control flow of information), 2 for Medium Degree of Autonomy (limited part of decision making and limited control in the flow of information), 3 for Low Degree of Autonomy (not part of decision making and has no control in the flow of information) or 4 for Unknown.	Offender B	1 - High Degree of Autonomy.
	Variable 27 - Social Support		
27.1	Social support refers to the various types of support (i.e., assistance/help) that people receive from others and is generally classified into three major categories: emotional, informational and instrumental (resource) support. According to the content in the case study, did any of the offenders or alleged offenders provide social support to other members or users?	Offender A	5 - Unknown.
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.	Offender B	5 - Unknown.
27.2	Did any of the offenders or alleged offenders received social support from other team members?		
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.	Offender A	5 - Unknown.
		Offender B	5 - Unknown.
	Variable 28 – Resources		
28.1	The provision of resources plays an important part in any successful project and organisation. The resources under consideration include among others, money, vehicles, people, properties and tools. Based on the information in the case study, which of these resources were provisioned by each offender or alleged offered?	Offender A	7 - Unknown.
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.	Offender B	7 - Unknown.
28.2	Based on the information in the case study, which resources were received by each offender or alleged offender?	Offender A	7 - Unknown.
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.	Offender B	7 - Unknown.

	Variable 29 – Others		
	This variable provides a high-level summary of the case.		
29.1	What evidence was provided against the offenders?	Evidence A	Voice recordings.
		Evidence B	Bank Account.
29.2	Which offender is implicated by the evidence?	Evidence A	Offender A.
		Evidence B	Offender A.
29.3	What was the main events and time frame/period for this case?	Event & Time Frame A	Pre-Crime Activities
		Event & Time Frame B	Main Event: 24 Counts of Criminal Activities between 7 January 2008 and 5 November 2008.
		Event & Time Frame C	Post-Crime Activities - Trial and Appeal.
29.4	What was the official charge or indictment for the case?	Charge A	Offenders were charged on indictment with one offence pursuant to s 400.4(1) of the Criminal Code (Cth) (the Code).
		Charge B	In the alternative, they were charged with an offence pursuant to s 400.4(2) of the Code.
29.5	What is/was the proposed/final verdict in relation to each offender?	Charge A	Offenders A and B were found guilty.
		Charge B	Not Applicable.
29.6	What is/was the proposed/final punishment for each of the offenders?	Offender A: Trial.	Sentenced to 3 years 6 months of imprisonment, with a non-parole period of 2 years 4 months.
		Offender A: Appeal.	Sentenced to 8 years of imprisonment, with a non-parole period of 4 years 6 months.
		Offender B: Trial.	Sentenced to 2 years and 9 months of imprisonment, with a non-parole period of 2 years.
	Variable 30 - Attitude Towards Victims		

Ref No.	Variable Description		Result
		Offender A	2 - No (Remorse).
30	Based on the information in the case study, what was the attitude of each offender or alleged offender towards the victims?		
	Select one or more of the following: 1 Yes for Remorse, 2 No for No Remorse or 3 for Unknown.	Offender B	1 - Yes (Remorse).
	Variable 31 - Miscellaneous Information		
31	List any other miscellaneous information which is/was deemed as important in the case, per offender basis.	Offender A	None.
		Offender B	None.

Table B.2.1: Summary of Code Schedule for Case Study Eleven – Researcher.

Ref No.	Variable Description		Result
	Variable 1 – General		
1.1	How many offenders or alleged offenders are listed in the case study?		2
1.2	For each offender or alleged offender, please categories their role in the organisation.		
	Select one of the following types of roles: 1 for Management, 2 for Soldier (worker in organised crime group), 3 for User of illicit goods or 4 for unknown.	Offender A	1
		Offender B	1
1.3	What is the relationship between the different offenders or alleged offenders?		
	Select one of the following relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) or 8 for Unknown.	Offender A and Offender B	5
1.4	Are there any special events documented in the case study?		
	Select one of the following: 1 for No special event, 2 for Meetings, 3 for Marriage, 4 for Family gatherings, 5 for Funerals or 6 for Unknown.		1
1.5	Identify the persons with skilled professions in the case study.		
	Select one of the following: 1 for Military skills, 2 for Engineering skills, 3 for Higher education skills (Professor), 4 for Political skills, 5 for Lawyer skills, 6 for Law enforcement skills, 7 for Accounting skills or 8 for Unknown.	Skilled Person A	7
		Skilled Person B	8
1.6	Where was the crime committed?		
	Select one of the following: 1 for WA, 2 for SA, 3 for NSW, 4 for ACT, 5 for NT, 6 for QLD, 7 for Oversees or 8 for Unknown.		3
1.7	Select the main organisational task for each role player in the case study.		

		Select one of the following: 1 Criminal activity within group, 2 for Protecting the group, 3 for Specialised support (e.g. manage resources), 4 for User support, 5 for Social support (members of group who are also business leaders), 6 for Others or 7 for Unknown.	Offender A	1
			Offender B	1
1.8	Based on the narrative of the case study, what would you identify as the motive for the offence/s or alleged offence/s.			
		Select one of the following: 1 for Financial benefits, 2 for Status benefits, 3 for Political gain, 4 for Others or 5 for Unknown.		1
1.9	Which tools are listed in the case study that was used as the conduit through which the offenders or alleged offenders conducted the crime?			
		Select one of the following: 1 for Computers, 2 for Mobile phones, 3 for E-mails via computer or Phones, 4 for Electronic Social Media via computer or phones, 5 for Others or 6 for Unknown.		3
1.10	Which resources were exerted by the respective offenders or alleged offenders?			
		Select one of the following: 1 for Capital funds, 2 for Vehicles, 3 for People, 4 for Weapons, 5 for Electronic tools, 6 for Others or 7 for Unknown.	Offender A	5
			Offender B	5
1.11	How many witnesses are listed in the case study?			
				2
1.12	What is the relationship between the different witnesses and offenders?			
		Select one of the following relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) 8 for No relationship or 9 for Unknown.	Witness A and Offender A	8
			Witness A and Offender B	5
			Witness B and Offender A	8
			Witness B and Offender B	8
1.13	How many victims are listed in the case study?			
				21
		Variable 2 - Type of Crime - Serious		
2	Which type of serious crime/s was committed by the offenders or alleged offenders?			
		Select one of the following: 1 for Murder and Non-Negligent Manslaughter, 2 for Rape, 3 for Robbery, 4 for Aggravated Assault, 5 for Burglary, 6 for Theft, 7 for Arson, 8 for Drug Offences Serious, 9 for Planning, Organising and Engaging in serious crime activities, 10 for Unknown or 11 for Not Applicable.	Offender A	N/A.
			Offender B	N/A.
		Variable 3 - Type of Crime - Non-Serious		
3		Which type of non-serious crime/s was committed by the offenders or		

	alleged offenders?		
	Select one of the following: 1 for Simple Assault, 2 for Forgery, 3 for Counterfeiting, 4 for Fraud, 5 for Embezzlement, 6 for Stolen Property, 7 for Family Offences, 8 for Sex Offences, 9 for Gambling, 10 for Vandalism, 11 for Drug Offences Non-Serious, 12 for Human Trafficking, 13 for Unknown or 14 for Not Applicable.	Offender A	4
		Offender B	4
	Variable 4 – Weapon		
4	Which type of weapon was used by the offender or alleged offender to commit the crime?		
	Select one of the following: 1 for Firearm, 2 for Knifes, 3 for Blunt Object, 4 for Personal Weapons, 5 for Explosives, 6 for Narcotics and Drugs, 7 for Unknown or 8 for Others.	Offender A	8
		Offender B	8
	Variable 5 – Age		
5	What is the age group for each offender or alleged offender?		
	Select one of the following: 1 for 0 to 18 years, 2 for 19 to 30 years, 3 for 31 to 45 years, 4 for older than 46 years or 5 for Unknown.	Offender A	3
		Offender B	5
	Variable 6 – Gender		
6	Based on the description in the case study, could you identify the gender of the offenders or alleged offenders?	Offender A	2
	Select one of the following: 1 for Male, 2 for Female or 3 for Unknown.	Offender B	1
	Variable 7 – Race		
7	What is the ethnical background of the offender or alleged offender?	Offender A	3
	Select one of the following: 1 for White, 2 for Black, 3 for Asian, 4 for Others or 5 for Unknown.	Offender B	5
	Variable 8 – IQ		
8	Based on the description in the case study, how will you describe the intelligence quotient (IQ) of the offenders or alleged offenders?	Offender A	2
	Select one of the following: 1 for Low, 2 for Medium, 3 for High or 4 for Unknown.	Offender B	2
	Variable 9 - Relationship of Victim to Offender		
9	What is the relationship between the offender and victim?	Offender A	3
	Select one of the following: 1 for Family, 2 for Outside Family or 3 for Unknown.	Offender B	3
	Variable 10 - Differential Reinforcement		
10.1	Differential reinforcement in a nutshell refers to the balance of anticipated or actual rewards and punishments that result after completion of a certain act or behaviour. According to this description, what was the anticipated reward for each of the offenders or alleged offenders?	Offender A	1

	Select one of following: 1 for Financial Rewards, 2 for Status Rewards, 3 Other Rewards or 4 for Unknown.	Offender B	1
10.2	Also, based on the previous definition, what was the anticipated punishment for each of the offenders or alleged offenders?		
	Select one of the following: 1 for Community Release, 2 for Imprisonment, 3 for Suspended Sentence, 4 for Other Punishment or 5 for Unknown.	Offender A	2
		Offender B	2
	Variable 11 – Definitions		
11	Definitions relate to the attitudes or meanings that individuals attach to a given behaviour. Based on the given definition, what attitude towards law enforcers did the offenders or alleged offenders exhibited.	Offender A	2
	Select one of the following: 1 for Positive Attitudes, 2 for Negative Attitudes or 3 for Unknown.	Offender B	1
	Variable 12 – Imitation		
12	Imitation is defined as the engagement in behaviour after the observation of similar behaviour in others. Based on the description of the definition and the content in the case study, do the offenders or alleged offenders follow protocol and terms of the organised crime organisation?	Offender A	2
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2
	Variable 13 - Social Structure		
13.1	Social structures and the behaviour of individuals all contribute to the general learning for individuals. As a consequence, which social class best representing each offender or alleged offender?	Offender A	4
	Select one of the following: 1 for Proprietors, 2 for Worker Class, 3 for Jobless or 4 for Unknown.	Offender B	4
13.2	Do any of the offenders or alleged offenders have family members or acquaintances that are part of the organised crime group or any other crime syndicate?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1
		Offender B	1
13.3	Do any of the offenders or alleged offenders have school association with other members of the organised crime group or any other crime syndicate?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	2
		Offender B	2
	Variable 14 – Attachment		
14.1	Attachment to others is seen as a strong indicator of the future behaviour of individuals. Openness to communicate with others is an important element of bonding to others. Therefore, based on the evidence in the case study, does each offender or alleged offender exhibit openness to communicate with others?	Offender A	2
	Select one of the following: 1 for Low Openness, 2 for Medium Openness, 3 for High Openness or 4 for Unknown.	Offender B	3
14.2	Do the offenders or alleged offenders display any signs of affection or fostering relationships with others members in the organisation or other crime groups?		
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1
		Offender B	1

		Variable 15 – Involvement		
		The involvement variable relates to a person's obsession in conventional activities, such as studying, spending time with family and participation in extra-curricular activities. From the background data in the case study, is there any evidence of participation of sport activities by offenders or alleged offenders.	Offender A	2
15.1				
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2
15.2		Is there any evidence in the case study of participation of hobby or recreational activities by offenders or alleged offenders?		
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1
			Offender B	1
15.3		Is there any evidence in the case study that indicates close relationships by offenders or alleged offenders?		
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	1
			Offender B	1
		Variable 16 - Informal Label		
		Labels in general associated with individuals may affect their self-identity and could transform them so that they see themselves in the light of the label or self-fulfilling prophecy. Furthermore, informal labels imitate labels produced by parents, teachers and peers with respect to individuals. Based on the content of the case study, how did the peers appraise the offenders or alleged offenders?	Offender A	3
16.1				
		Select one of the following: 1 for Cooperative, 2 for Troublesome or 3 for Unknown.	Offender B	3
16.2		Based on the content of the case study, how did the parents, teachers or peers rate the attitude of each offender or alleged offender?		
		Select one of the following: 1 for Good, 2 for Bad or 3 for Unknown.	Offender A	3
			Offender B	3
16.3		Based on the content of the case study, how did the parents, teachers or peers rate the behaviour of each offender or alleged offender?		
		Select one of the following: 1 for Conforming, 2 for Deviant, 3 for Obedient, 4 for Polite, 5 for Rude, 6 for Law-abiding or 7 for Unknown.	Offender A	7
			Offender B	7
		Variable 17 - Goal Disappointment		
		Goals pertaining to this variable encompass immediate, ideal and future goals. Examples of such goals can include adequate education, employment/occupation, dwellings and so forth. Based on the information in the case study, could you establish any failed educational aspirations for each offender or alleged offender?	Offender A	1
17.1				
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender B	2
17.2		Based on the information in the case study, do you believe the offender or alleged offender has established employment of personal choice?		
		Select one of the following: 1 for Successful (has established employment of personal choice), 2 for Unsuccessful or 3 for Unknown.	Offender A	3
			Offender B	3
17.3		Based on the information in the case study, do you believe the offender or alleged offender has valued the importance of high school status?		
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.	Offender A	2
			Offender B	3

18	*Variable 18 - Removal of Positive Stimuli*			
	Removal of positive or desired stimuli from an individual relates to the experience of an individual with stressful events that can lead to anomic feelings. Examples of this situation include the loss of a friend, serious illness, death of a friend or family member, separation of parents, and so forth. By analysing the case study, is there any evidence that indicate the loss of a friend or family member for each of the offenders or alleged offenders?		Offender A	2
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.		Offender B	2
	Variable 19 - Exposure to Negative Stimuli			
19.1	Negative stimuli variable refers to certain stressful life events that involve the confrontation of individuals with negative actions by others. Such stressful events include child abuse or neglect, criminal victimisation, verbal threats and insults, and negative relations with parents and peers. According to the contents of the case study, is there any evidence suggesting that the offender or alleged offender is/was in conflict with his/her parents and/or peers?		Offender A	1
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.		Offender B	2
19.2	Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to child abuse?			
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.		Offender A	2
			Offender B	2
19.3	Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to verbal threads?			
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.		Offender A	1
			Offender B	2
	Variable 20 - Family Structure Philosophy			
20	The family structure variable shapes the social reproduction of gender relations and as a consequence the social distribution of delinquencies. Typical values for this variable could include family controls that promote risk taking (investing in properties, holidaying in high risk countries, friendship with convicted criminals or alleged criminals, etc.) or risk aversive. Based on the background information in the case study, is there any evidence that describe the family risk profile for each offender or alleged offender?		Offender A	3
	Select one of the following: 1 for Risk Taking, 2 for Risk Aversive or 3 for Unknown.		Offender B	3
	Variable 21 - Capitalistic Economic System			
21	A Capitalist Economic System is one characterised by free markets and the absence of government intervention in the economy. Private individuals or corporations who have the means of production, distribution, and exchange of wealth are classified as the powerful class of the society. (In many cases, they will own one or more properties and/or businesses). To the contrary, the powerless class of society own no properties or businesses. From the contents of the case study, which economic social class would you label each offender or alleged offender?		Offender A	1
	Select one of the following: 1 for Powerful Class, 2 for Powerless Class or 3 for Unknown.		Offender B	1

	Variable 22 - Family Culture		
22	The family culture variable is described either as strong Patriarchal or strong Egalitarian. Patriarchal culture is marked by the supremacy of the father in the family, the legal dependence of wives and children, and the reckoning of descent and inheritance in the male line; broadly control by men of a disproportionately large share of power. Egalitarian culture on the other hand represents a belief in human equality especially with respect to social, political, and economic affairs. Based on these two definitions and evidence in the case study, how would you classify the family culture of the offenders or alleged offenders?	Offender A	3
	Select one of the following: 1 for Strong Patriarchal, 2 for Strong Egalitarian or 3 for Unknown.	Offender B	3
	Variable 23 - Roles		
23	Please see questions 1.2 and 1.7.		
	Variable 24 - Status		
24	Status hierarchies in groups are dynamic and can vary over time. In this context, status stems from two separate sets of characteristics, namely, specific status characteristics and diffuse status characteristics. Specific status characteristics refer to attributes that relate directly to the ability of the member of the group to perform his or her task, e.g. being a loyal and hard worker. Diffuse status characteristics on the other hand refer to attributes that do not relate directly to the ability of the member to perform his or her task, but rather refer to the member's status in the society, e.g. being wealthy. The overall status of each member of a group is determined by the sum total of both specific and diffuse statuses. By taking last mentioned into consideration, how would you rate the status of each offender or alleged offender in the case?	Offender A	3
	Select one of the following: 1 for High Status, 2 for Medium Status, 3 for Low Status or 4 for Unknown.	Offender B	4
	Variable 25 - Official Communication Policy		
25.1	Communication networks range from highly centralised to highly decentralise. In centralised communication networks, one or a few members control the flow of information throughout the network. In decentralised communication network, communication among members is unregulated and in some cases, communication is limited to smaller decentralised parts of the network. According to the content of the case study, how would you classify the communication network of the criminal or alleged criminal group?		1
	Select one of the following: 1 for Centralised, 2 for Decentralised, 3 for Unknown.		
25.2	Which communication method was used by the offenders or alleged offenders to communicate within and outside the group?	Offender A	1
	Select one or more of the following: 1 for Verbal-in-person, 2 for Verbal thru Electronic Media (mobile), 3 for Written-on-paper, 4 for Written thru Electronic Mail, 5 for Written thru Social Networks or 6 for Unknown.	Offender B	1
	Variable 26 - Degree of Autonomy		

26	The degree of autonomy variable refers to the ability of the offender or alleged offender to make decision without consulting others, controlling the flow of information and performing general tasks within the crime group or syndicate without having to request permission and report progress with regular intervals. Research has pointed out that in a centralised communication structure, the hub or core members have normally more power, less restricted and fully independent compared to the peripheral members. In a decentralised communication network, all members normally experience a high level of autonomy. By analysing the case study, how would you rate the degree of autonomy pertaining to each offender or alleged offender?	Offender A	1
	Select one of the following: 1 for High Degree of Autonomy (making decisions and control flow of information), 2 for Medium Degree of Autonomy (limited part of decision making and limited control in the flow of information), 3 for Low Degree of Autonomy (not part of decision making and has no control in the flow of information) or 4 for Unknown.	Offender B	1
	Variable 27 - Social Support		
27.1	Social support refers to the various types of support (i.e., assistance/help) that people receive from others and is generally classified into three major categories: emotional, informational and instrumental (resource) support. According to the content in the case study, did any of the offenders or alleged offenders provide social support to other members or users?	Offender A	1
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.	Offender B	2
27.2	Did any of the offenders or alleged offenders received social support from other team members?		
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.	Offender A	1
		Offender B	2
	Variable 28 – Resources		
28.1	The provision of resources plays an important part in any successful project and organisation. The resources under consideration include among others, money, vehicles, people, properties and tools. Based on the information in the case study, which of these resources were provisioned by each offender or alleged offered?	Offender A	5
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.	Offender B	5
28.2	Based on the information in the case study, which resources were received by each offender or alleged offender?	Offender A	5
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.	Offender B	5
	Variable 29 – Others		
	This variable provides a high-level summary of the case.		
29.1	What evidence was provided against the offenders?	Evidence A	Tele-files from ATO.
		Evidence B	None.
29.2	Which offender is implicated by the evidence?	Evidence A	Offender A & B.
		Evidence B	None.

				Defrauding ATO of tax returns of 21 individuals.
29.3	What was the main events and time frame/period for this case?	Event & Time Frame A		
		Event & Time Frame B		Identity theft.
		Event & Time Frame C		1 Jan 2008 to 24 Oct 2008.
29.4	What was the official charge or indictment for the case?	Charge A		Fraud.
		Charge B		None.
29.5	What is/was the proposed/final verdict in relation to each offender?	Charge A		Offenders A & B were quilty.
		Charge B		N/A.
29.6	What is/was the proposed/final punishment for each of the offenders?	Charge A		Imprisonment.
		Charge B		
	Variable 30 - Attitude Towards Victims			
30	Based on the information in the case study, what was the attitude of each offender or alleged offender towards the victims?	Offender A		1
	Select one or more of the following: 1 Yes for Remorse, 2 No for No Remorse or 3 for Unknown.	Offender B		1
	Variable 31 - Miscellaneous Information			
31	List any other miscellaneous information which is/was deemed as important in the case, per offender basis.	Offender A		None.
		Offender B		None.

Table B.2.2: Summary of Code Schedule for Case Study Eleven – Research Assistant.

Appendix C

Final List of Independent Variables

C.1   Prelude:

This appendix combines the content of table 3.1, list of selected independent variables, as articulated in chapter 3, with the findings of the case study research in relation to additional variables, as conducted in chapter 6 and appendix B.

In chapter 3, a diverse range of criminological theories associated with crimes and criminalities in general were introduced and examined, with the main aim to identify suitable attributes or variables that can be exerted to gain a comprehensive understanding of organised crime activities and perpetrators. The corollary of this process was the identification of eight general crime variables, seven social-psychological variables, six sociological variables and seven social network variables, all of which are listed in table 3.1.

In chapter 6 and appendix B, table 3.1 is used as baseline for conducting the content analyses on the eleven substantive cases by coding the most important aspects of each case. Whilst analysing the cases, additional general crime variables were identified that further explicated important aspects of the cases. As a consequence, two additional general crime variables are included in the final list of independent variables designated for inclusion in OCRM and future research related to this project.

Table C.1 outlines the final thirty independent variables in the following sequence:

- Variables 1 to 8 are applicable to general crime variables as listed in table 3.1;
- Variables 9 to 15 pertain to social-psychological variables as recorded in table 3.1 ;
- Variables 16 to 21 relate to sociological variables as itemised in table 3.1 ;
- Variables 22 to 28 refer to social network variables as denoted in table 3.1; and
- Variables 29 and 30 are the two newly identified general crime variables.

Ref No.	Variable Description
	Variable 1 – General Information
1.1	Amount of Offenders or alleged Offenders.
1.2	The Role of each Offender or alleged Offender in the Organisation.
	Types of roles: 1 for Management, 2 for Soldier (worker in organised crime group), 3 for User of illicit goods or 4 for unknown.
1.3	The Relationship between the different Offenders or alleged Offenders.
	Types of relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) or 8 for Unknown.
1.4	Special Events.
	Types of special events: 1 for No special event, 2 for Meetings, 3 for Marriage, 4 for Family gatherings, 5 for Funerals or 6 for Unknown.
1.5	Actors with Skilled Professions.
	Types of professions: 1 for Military skills, 2 for Engineering skills, 3 for Higher education skills (Professor), 4 for Political skills, 5 for Lawyer skills, 6 for Law enforcement skills, for Accounting skills or 8 for Unknown.
1.6	Crime Location.
	Locations: 1 for WA, 2 for SA, 3 for NSW, 4 for ACT, 5 for NT, 6 for QLD, 7 for Oversees or 8 for Unknown.
1.7	Main Organisational Task for each Role Player.
	Types of Roles: 1 Criminal activity within group, 2 for Protecting the group, 3 for Specialised support (e.g. manage resources), 4 for User support, 5 for Social support (members of group who are also business leaders), 6 for Others or 7 for Unknown.
1.8	Motive for the Offence/s or alleged Offence/s.
	Types of Motives: 1 for Financial benefits, 2 for Status benefits, 3 for Political gain, 4 for Others or 5 for Unknown.
1.9	Tools.

	Types of Tools: 1 for Computers, 2 for Mobile phones, 3 for E-mails via computer or Phones, 4 for Electronic Social Media via computer or phones, 5 for Others or 6 for Unknown.	
1.10	General Resources Exerted by the respective Offenders or alleged Offenders?	
	Types of Resources: 1 for Capital funds, 2 for Vehicles, 3 for People, 4 for Weapons, 5 for Electronic tools, 6 for Others or 7 for Unknown.	
1.11	Amount of Witnesses.	
1.12	Relationship between the Witnesses and Offenders?	
	Types of Relationships: 1 for Transactional (gift, economic sales, exchange or physical items), 2 for Communication (linkages between actors via communications channels), 3 for Boundary penetration (memberships or boards of directors with overlapping members), 4 for Instrumental (secure sales, valuable goods, services, information or advice), 5 for Sentimental (affection, deference, loathing or hostility), 6 for Authority/Power (right and obligations of actors to obey commands in organisations), 7 for Kinship (bonds of blood or marriage) 8 for No relationship or 9 for Unknown.	
1.13	Amount of Victims.	
2	*Variable 2 - Type of Crime – Serious*	
	Types of Serious Crimes: 1 for Murder and Non-Negligent Manslaughter, 2 for Rape, 3 for Robbery, 4 for Aggravated Assault, 5 for Burglary, 6 for Theft, 7 for Arson, 8 for Drug Offences Serious, 9 for Planning, Organising and Engaging in serious crime activities, 10 for Unknown or 11 for Not Applicable.	
3	*Variable 3 - Type of Crime - Non-Serious*	
	Types of Non-Serious Crimes: 1 for Simple Assault, 2 for Forgery, 3 for Counterfeiting, 4 for Fraud, 5 for Embezzlement, 6 for Stolen Property, 7 for Family Offences, 8 for Sex Offences, 9 for Gambling, 10 for Vandalism, 11 for Drug Offences Non-Serious, 12 for Human Trafficking, 13 for Unknown or 14 for Not Applicable.	
4	*Variable 4 – Weapon*	
	Types of Weapons: 1 for Firearm, 2 for Knifes, 3 for Blunt Object, 4 for Personal Weapons, 5 for Explosives, 6 for Narcotics and Drugs, 7 for Unknown or 8 for Others.	
5	*Variable 5 – Age*	
	Range of Age Groups: 1 for 0 to 18 years, 2 for 19 to 30 years, 3 for 31 to 45 years, 4 for older than 46 years or 5 for Unknown.	

6	*Variable 6 – Gender*
	Range of Gender Types: 1 for Male, 2 for Female or 3 for Unknown.
7	*Variable 7 – Race*
	Range of Race Types: 1 for White, 2 for Black, 3 for Asian, 4 for Others or 5 for Unknown.
8	*Variable 8 – IQ (Intelligence Quotient)*
	Range of IQ Classes: 1 for Low, 2 for Medium, 3 for High or 4 for Unknown.
9	*Variable 9 - Relationship of Victim to Offender*
	Types of Relationships: 1 for Family, 2 for Outside Family or 3 for Unknown.
10	*Variable 10 - Differential Reinforcement*
	Differential reinforcement in a nutshell refers to the balance of anticipated or actual rewards and punishments that result after completion of a certain act or behaviour.
	Types of Rewards: 1 for Financial Rewards, 2 for Status Rewards, 3 Other Rewards or 4 for Unknown.
	Types of Punishment: 1 for Community Release, 2 for Imprisonment, 3 for Suspended Sentence, 4 for Other Punishment or 5 for Unknown.
11	*Variable 11 – Definitions*
	Definitions relate to the attitudes or meanings that individuals attach to a given behaviour.
	Types of Attitudes: 1 for Positive Attitudes, 2 for Negative Attitudes or 3 for Unknown.
12	*Variable 12 – Imitation*
	Imitation is defined as the engagement in behaviour after the observation of similar behaviour in others.
	Selection Criteria: 1 for Yes, 2 for No or 3 for Unknown.
	Variable 13 - Social Structure

13.1	Social structures and the behaviour of individuals all contribute to the general learning for individuals. As a consequence, which social class best representing each offender or alleged offender?
	Select one of the following: 1 for Proprietors, 2 for Worker Class, 3 for Jobless or 4 for Unknown.
13.2	Do any of the offenders or alleged offenders have family members or acquaintances that are part of the organised crime group or any other crime syndicate?
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
13.3	Do any of the offenders or alleged offenders have School association with other members of the organised crime group or any other crime syndicate?
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
	Variable 14 – Attachment
14.1	Attachment to others is seen as a strong indicator of the future behaviour of individuals. Openness to communicate with others is an important element of bonding to others. Therefore, based on the evidence in the case study, does each offender or alleged offender exhibit openness to communicate with others?
	Select one of the following: 1 for Low Openness, 2 for Medium Openness, 3 for High Openness or 4 for Unknown.
14.2	Do the offenders or alleged offenders display any signs of affection or fostering relationships with others members in the organisation or other crime groups?
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
	Variable 15 – Involvement
15.1	The involvement variable relates to a person's obsession in conventional activities, such as studying, spending time with family and participation in extra-curricular activities. From the background data in the case study, is there any evidence of participation of sport activities by offenders or alleged offenders.
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
15.2	Is there any evidence in the case study of participation of hobby or recreational activities by offenders or alleged offenders?
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
15.3	Is there any evidence in the case study that indicates close relationships by offenders or alleged offenders?
	Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.

		Variable 16 - Informal Label
16.1		Labels in general associated with individuals may affect their self-identity and could transform them so that they see themselves in the light of the label or self-fulfilling prophecy. Furthermore informal labels imitate labels produced by parents, teachers and peers with respect to individuals. Based on the content of the case study, how did the peers appraised the offenders or alleged offenders?
		Select one of the following: 1 for Cooperative, 2 for Troublesome or 3 for Unknown.
16.2		Based on the content of the case study, how did the parents, teachers or peers rate the attitude of each offender or alleged offender?
		Select one of the following: 1 for Good, 2 for Bad or 3 for Unknown.
16.3		Based on the content of the case study, how did the parents, teachers or peers rate the behaviour of each offender or alleged offender?
		Select one of the following: 1 for Conforming, 2 for Deviant, 3 for Obedient, 4 for Polite, 5 for Rude, 6 for Law-abiding or 7 for Unknown.
		Variable 17 - Goal Disappointment
17.1		Goals pertaining to this variable encompass immediate, ideal and future goals. Examples of such goals can include adequate education, employment/occupation, dwellings and so forth. Based on the information in the case study, could you establish any failed educational aspirations for each offender or alleged offender?
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
17.2		Based on the information in the case study, do you believe the offender or alleged offender has established employment of personal choice?
		Select one of the following: 1 for Successful (has established employment of personal choice), 2 for Unsuccessful or 3 for Unknown.
17.3		Based on the information in the case study, do you believe the offender or alleged offender has valued the importance of high school status?
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
		Variable 18 - Removal of Positive Stimuli
18		Removal of positive or desired stimuli from an individual relates to the experience of an individual with stressful events that can lead to anomic feelings. Examples of this situation include the loss of a friend, serious illness, death of a friend or family member, separation of parents, and so forth. By analysing the case study, is there any evidence that indicate the loss of a friend or family member for each of the offenders or alleged offenders?

		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
		Variable 19 - Exposure to Negative Stimuli
19.1		Negative stimuli variable refers to certain stressful life events that involve the confrontation of individuals with negative actions by others. Such stressful events include child abuse or neglect, criminal victimisation, verbal threats and insults, and negative relations with parents and peers. According to the contents of the case study, is there any evidence suggesting that the offender or alleged offender is/was in conflict with his/her parents and/or peers?
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
19.2		Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to child abuse?
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
19.3		Is there any evidence in the case study which suggests the offender or alleged offender has been exposed to verbal threads?
		Select one of the following: 1 for Yes, 2 for No or 3 for Unknown.
		Variable 20 - Family Structure Philosophy
20		The family structure variable shapes the social reproduction of gender relations and as a consequence the social distribution of delinquencies. Typical values for this variable could include family controls that promote risk taking (investing in properties, holidaying in high risk countries, friendship with convicted criminals or alleged criminals, etc.) or risk aversive. Based on the background information in the case study, is there any evidence that describe the family risk profile for each offender or alleged offender?
		Select one of the following: 1 for Risk Taking, 2 for Risk Aversive or 3 for Unknown.
		Variable 21 - Capitalistic Economic System
21		A Capitalist Economic System is one characterised by free markets and the absence of government intervention in the economy. Private individuals or corporations who have the means of production, distribution, and exchange of wealth are classified as the powerful class of the society. (In many cases, they will own one or more properties and/or businesses). To the contrary, the powerless class of society own no properties or businesses. From the contents of the case study, which economic social class would you label each offender or alleged offender?
		Select one of the following: 1 for Powerful Class, 2 for Powerless Class or 3 for Unknown.
		Variable 22 - Family Culture

22	The family culture variable is described either as strong Patriarchal or strong Egalitarian. Patriarchal culture is marked by the supremacy of the father in the family, the legal dependence of wives and children, and the reckoning of descent and inheritance in the male line; broadly control by men of a disproportionately large share of power. Egalitarian culture on the other hand represents a belief in human equality especially with respect to social, political, and economic affairs. Based on these two definitions and evidence in the case study, how would you classify the family culture of the offenders or alleged offenders?	
	Select one of the following: 1 for Strong Patriarchal, 2 for Strong Egalitarian or 3 for Unknown.	
	Variable 23 – Roles	
23	Please see questions 1.2 and 1.7.	
	Variable 24 – Status	
24	Status hierarchies in groups are dynamic and can vary over time. In this context, status stems from two separate sets of characteristics, namely, specific status characteristics and diffuse status characteristics. Specific status characteristics refer to attributes that relate directly to the ability of the member of the group to perform his or her task, e.g. being a loyal and hard worker. Diffuse status characteristics on the other hand refer to attributes that do not relate directly to the ability of the member to perform his or her task, but rather refer to the member's status in the society, e.g. being wealthy. The overall status of each member of a group is determined by the sum total of both specific and diffuse statuses. By taking last mentioned into consideration, how would you rate the status of each offender or alleged offender in the case?	
	Select one of the following: 1 for High Status, 2 for Medium Status, 3 for Low Status or 4 for Unknown.	
	Variable 25 - Official Communication Policy	
25.1	Communication networks range from highly centralised to highly decentralise. In centralised communication networks, one or a few members control the flow of information throughout the network. In decentralised communication network, communication among members is unregulated and in some cases, communication is limited to smaller decentralised parts of the network. According to the content of the case study, how would you classify the communication network of the criminal or alleged criminal group?	
	Select one of the following: 1 for Centralised, 2 for Decentralised, 3 for Unknown.	
25.2	Which communication method was used by the offenders or alleged offenders to communicate within and outside the group?	
	Select one or more of the following: 1 for Verbal-in-person, 2 for Verbal thru Electronic Media (mobile), 3 for Written-on-paper, 4 for Written thru Electronic Mail, 5 for Written thru Social Networks or 6 for Unknown.	
	Variable 26 - Degree of Autonomy	

26	The degree of autonomy variable refers to the ability of the offender or alleged offender to make decision without consulting others, controlling the flow of information and performing general tasks within the crime group or syndicate without having to request permission and report progress with regular intervals. Research has pointed out that in a centralised communication structure, the hub or core members have normally more power, less restricted and fully independent compared to the peripheral members. In a decentralised communication network, all members normally experience a high level of autonomy. By analysing the case study, how would you rate the degree of autonomy pertaining to each offender or alleged offender?
	Select one of the following: 1 for High Degree of Autonomy (making decisions and control flow of information), 2 for Medium Degree of Autonomy (limited part of decision making and limited control in the flow of information), 3 for Low Degree of Autonomy (not part of decision making and has no control in the flow of information) or 4 for Unknown.
	Variable 27 - Social Support
27.1	Social support refers to the various types of support (i.e., assistance/help) that people receive from others and is generally classified into three major categories: emotional, informational and instrumental (resource) support. According to the content in the case study, did any of the offenders or alleged offenders provide social support to other members or users?
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.
27.2	Did any of the offenders or alleged offenders received social support from other team members?
	Select one of the following: 1 for Emotional Support, 2 for Informational Support, 3 for Resource Support, 4 for No Support or 5 for Unknown.
	Variable 28 – Resources
28.1	The provision of resources plays an important part in any successful project and organisation. The resources under consideration include among others, money, vehicles, people, properties and tools. Based on the information in the case study, which of these resources were provisioned by each offender or alleged offered?
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.
28.2	Based on the information in the case study, which resources were received by each offender or alleged offender?
	Select one or more of the following: 1 for Money (funds), 2 for Vehicle, 3 for People, 4 for Properties, 5 for Tools, 6 for No Support or 7 for Unknown.
	Variable 29 – Others

		This variable provides a high level summary of the case.
29.1		What evidence was provided against the offenders?
29.2		Which offender is implicated by the evidence?
29.3		What was the main events and time frame/period for this case?
29.4		What was the official charge or indictment for the case?
29.5		What is/was the proposed/final verdict in relation to each offender?
29.6		What is/was the proposed/final punishment for each of the offenders?
		Variable 30 - Attitude Towards Victims
30		Based on the information in the case study, what was the attitude of each offender or alleged offender towards the victims?
		Select one or more of the following: 1 Yes for Remorse, 2 No for No Remorse or 3 for Unknown.

Table C.1: The Final List of Independent Variables.

Appendix D

Prototype:

OCIPS – The Implementation Results

D.1   Prelude:

In chapter 8, the prototyping episode of this project, a comprehensive explanation is provided as to how the conceptual model (Organised Crime Reconnaissance Model (OCRM)) was operationalized, tested and evaluated.   The prototype environment in which the testing and evaluation were conducted is called Organised Crime Investigation Prototype System (OCIPS).   The main functionalities of OCIPS are listed below:

- Information sourcing;
- Information collecting and refining;
- Centralisation of databases;
- Refining nodes and edges information;
- Implementing network science analysis;
- Appraising conviction verdict and calculating appropriate punishment;
- Proposing preventative strategy;
- Conducting high-level crime analysis; and
- Presenting computed results.

OCIPS utilizes a suite of independent software packages to implement above functionalities, as well as to test and evaluate twelve test case scenarios. The four core sub-components of the conceptual model encompass the network science analysis, conviction verdict and punishment analysis, preventative strategy proposal and high-level crime analysis components.   These core sub-components are implemented primarily through an off-the-shelf network analysis toolkit and standard spreadsheet program.

The analysis toolkit is called ORA-NetScence. It was developed by CMU and Netamomics to reason about networks, nodes, groups at both local and global network level. The tool can be used to implement network science, analyse social networks, identify key actors, examine changes in key nodes, examine changes in group membership, and so forth.

In chapter 8, a flagship case (case nine) was randomly selected and executed via OCIPS, in order to prove the concept and practicality of the model. The results of the case are studied and inferred in section 8.6 to evaluate and determine the correctness and effectiveness of the implementation, and to prove the concept of OCRM.

Moreover, the network science crime analysis engine and presentation of results components of OCRM are also executed on the remaining ten cases to create general inferences by comparing and contrasting network measures and key entity results among the various cases. The results of implementing these cases by means of the prototype are presented in this appendix, and are further articulated in chapter 8.

The implementation results of the remaining cases in OCRM are presented in the following arrangement:

- The overall crime report for each case; and
- Overall network diagram for each case.

D.2.1   Test Case Scenario Three: Case Study One – Static Meta-Network

This test case scenario is reflecting on test case one. The scenario applies standard network analysis as articulated in the first three steps of the exploration approach in chapter 4. The prototype is utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. The implementation methodology described in section 8.4.2 is executed similar to test case scenario one, followed by the compilation of the overall Crime Report (Table D.2.1) and capturing of a screenshot of the overall Network Diagram (Figure D.2.1). The content of the table and network diagram are used in the section 8.6 to augment the discussion on the results acquired by means of the prototype.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.003	0.003		
1.1.2	Std Dev	0	0.019	0.008		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0.1	0.188	0.069		
1.1.5	Sum Total	46.5	38	14		
1.1.6	Number of Nodes				203	
1.1.7	Number of Links				138	
1.1.8	Average Total Degree Centrality				0.003	
1.1.9	Average Clustering Coefficient for Network				0.11	
1.1.10	Network Centralisation				0.097	
1.1.11	Network Density				0.003	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.062	
1.1.14	Network Reciprocity				0.053	5.3% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A and B have about 70% of the total degrees and the rest of the nodes have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.003	138	0.68	1.513	
1.2.2	Core 3 Nodes (Offenders)	0.667	2	0.67	2	

1.3	Overall Network Diagram:	See Figure D.2.1			

2	*Overall Network Science Crime Analysis Report:*				
		Total Applicable Nodes	Measured Value		
2.1	Emergent Leaders:	1	Offender A (0.145)	Offender B (0.294)	Offender C (0.170)	Based on the efforts to perform their tasks and connection with others, offender B has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	1	Offender A (0)	Offender B (1)	Offender C (0)	There are two groups in the syndicate, and offender B has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (1)	Offender B (0)	Offender C (0.5)	Offender A acts as the information hub in the network. Thus, he is best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	1	Offender A (1)	Offender B (0)	Offender C (0.5)	Offender A acts as the authority in the criminal group. Thus, offender C is well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:	1	Offender A (0)	Offender B (1)	Offender C (0)	Offender B has the highest level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	3	Offender A	Offender B	Offender C	The syndicate consists of one main clique, but can further be segregated into two smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	2	Offenders A & B	Offenders B & C	N/A	The syndicate consists of one main clique, but can further be segregated into two smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (0.861)	Offender B (1)	Offender C (0.484)	The measured values indicate that offender B is more central to the clique in terms of the overall network and offender C is the least centred. Hence offender B is the most important member in the clique.
2.9	Offender Clustering Coefficient:	0	Offender A (0)	Offender B (0)	Offender C (0)	The measured value indicates a low cohesiveness among all offenders, which possibly means that the friends of each offender are not friends with the other two members.
2.10	Least Integrated Offender in Group	1	Offender A (0.145)	Offender B (0.294)	Offender C (0.170)	Offender A uses the least cognitive effort to do its task in the group and can therefore being seen as the least integrated offender.
2.11	Group Knowledge:	1	Offender A (0.444)	Offender B (0.467)	Offender C (0.089)	Offender B has the highest group knowledge due to his exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	1	Offender A (0.58)	Offender B (0.73)	Offender C (0.42)	Offender B has the highest workload in the syndicate based on the knowledge and resources used to perform the assigned tasks.

Table D.2.1: The Overall Crime Report for Case 1.
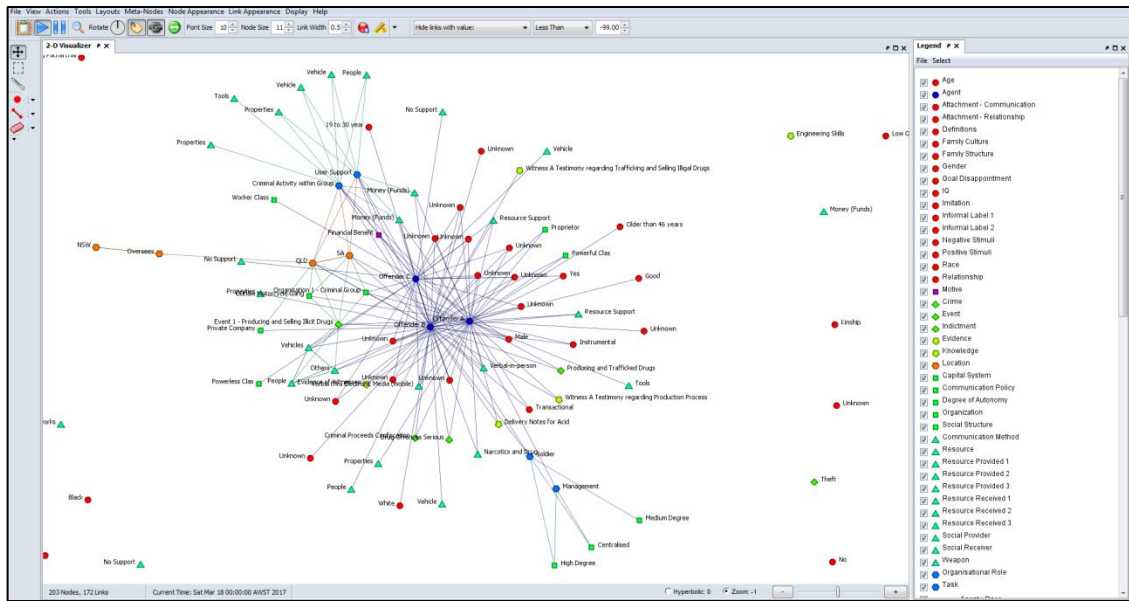
Figure D.2.1: Overall Network Diagram for Case 1.

D.2.2   Test Case Scenario Four: Case Study Two – Static Meta-Network

As per the previous test case scenarios, this scenario implements the standard network analysis as articulated in the first three steps of the exploration approach in chapter 4. The prototype is exerted to create a static meta-network of the criminal group for the time period indicated in the court transcript. The outputs of the prototype for this scenario are the overall Crime Report (Table D.2.2) and the overall Network Diagram (Figure D.2.2). The content of the table and diagram are used in section 8.6 to supplement the discussion on the results acquired by means of the prototype.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Between-ness	Out-Degree	In-Degree	Overall Network Value	
1.1.1	Mean	0	0.006	0.006		
1.1.2	Std Dev	0	0.027	0.011		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0.002	0.233	0.062		
1.1.5	Sum Total	96	49	13		
1.1.6	Number of Nodes				211	
1.1.7	Number of Links				248	
1.1.8	Average Total Degree Centrality				0.006	
1.1.9	Average Clustering Coefficient for Network				0.106	
1.1.1	Network				0.122	

			Density	No of Links (Relationships)	Average Links per Remaining Nodes	Average Path Distance	
0	Centralisation						
1.1.11	Network Density					0.006	
1.1.12	Network Diameter					4	
1.1.13	Average Network Eigenvector Centrality					0.082	
1.1.14	Network Reciprocity					0.051	5.1% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution					Power	
1.1.16	Network Layout					Scale-Free	Offenders A and C have about 72% of the total degrees and the rest have relatively low degrees.

1.2	**Network Density**						
		Density	No of Links (Relationships)	Average Links per Remaining Nodes	Average Path Distance	
1.2.1	Entire Matrix	0.006	248	1.18	1.588	
1.2.2	Core 5 Nodes (Offenders)	0.6	6	1.2	2.8	

1.3	**Overall Network Diagram:**	See Figure D.2.2

2	***Overall Network Science Crime Analysis Report:***						
		Total Applicable Nodes	**Measured Value**				
2.1	Emergent Leaders:	1	Offender A (0.317)	Offender B (0.144)	Offender C (0.212)	Offender D (0.209)	Offender E (0.224)	Based on the efforts to perform their tasks and connection with others, offender A has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	1	Offender A (1)	Offender B (0)	Offender C (0)	Offender D (0)	Offender E (0)	There are two groups in the syndicate, and offender A has concurrent membership in both overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (1)	Offender B (0.359)	Offender C (0.491)	Offender D (0.802)	Offender E (0.735)	Offender A acts as the information hub in the network. Thus, he is best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	1	Offender A (1)	Offender B (0.359)	Offender C (0.491)	Offender D (0.802)	Offender E (0.735)	Offender A acts as the authority in the criminal group. Thus, offender A is well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:		Offender A (0.500)	Offender B (0)	Offender C (0)	Offender D (0)	Offender E (0.167)	Offender A has the highest level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	5	Offender A	Offender B	Offender C	Offender D	Offender E	The syndicate consists of one main clique, but can further be segregated into five smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	5	Offenders A, C & E	Offenders A & C	Offenders A & B	Offenders A & D	Offenders A, D & E	The syndicate consists of one main clique, but can further be segregated into five smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.359)	Offender C (0.491)	Offender D (0.802)	Offender E (0.735)	The measured values indicate that offender A is more central to the main clique in terms of the overall network and offender B is the least centred. Hence, offender A is the most important member in the clique.

2.9	Offender Clustering Coefficient:	4	Offender A (0.333)	Offender B (0)	Offender C (1)	Offender D (1)	Offender E (0.667)	The measured value indicates a relative high cohesiveness among most offenders, which possibly means that the friends of each offender are also friends with the other members. This is especially applicable for offenders C and D. The exception is offender B.
2.10	Least Integrated Offender in Group	1	Offender A (0.317)	Offender B (0.144)	Offender C (0.212)	Offender D (0.209)	Offender E (0.224)	Offender B uses the least cognitive effort to do its task in the group and can therefore being seen as the least integrated offender.
2.11	Group Knowledge:	1	Offender A (0.286)	Offender B (0.149)	Offender C (0.144)	Offender D (0.233)	Offender E (0.187)	Offender A has the highest group knowledge due to his exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	1	Offender A (0.686)	Offender B (0.1)	Offender C (0.172)	Offender D (0.172)	Offender E (0.1)	Offender A has the highest workload in the syndicate based on the knowledge and resources used to perform the assigned tasks.

Table D.2.2: The Overall Crime Report for Case 2.

Figure D.2.2: Overall Network Diagram for Case 2.

D.2.3 Test Case Scenario Five: Case Study Three – Static Meta-Network

Test case scenario five is based on case study three and implements the standard network analysis technique. The prototype is once again being utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. The implementation methodology described in section 8.4.2 is also executed, followed by the compilation of the overall Crime Report (Table D.2.3) and capturing of a screenshot of the overall Network Diagram (Figure D.2.3). The content of the table and diagram are further discussed in section 8.6.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.004	0.004		
1.1.2	Std Dev	0	0.022	0.009		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0	0.189	0.063		
1.1.5	Sum Total	15	39	13		
1.1.6	Number of Nodes				207	
1.1.7	Number of Links				161	
1.1.8	Average Total Degree Centrality				0.004	
1.1.9	Average Clustering Coefficient for Network				0.128	
1.1.10	Network Centralisation				0.099	
1.1.11	Network Density				0.004	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.068	
1.1.14	Network Reciprocity				0.045	4.5% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A, B and C have about 65% of the total degrees and the rest have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.004	161	0.78	1.296	
1.2.2	Core 4 Nodes (Offenders)	1	6	1.5	1	
1.3	**Overall Network Diagram:**	See Figure D.2.3				
2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable Nodes	**Measured Value**			
2.1	Emergent Leaders:	4	Offender A (0.279)	Offender B (0.279)	Offender C (0.279)	Offender D (0.279)	Based on the efforts to perform their tasks and connection with others, all offenders have been equally earmarked as the emergent leader and anyone could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.

2.3	Hubs:	4	Offender A (1)	Offender B (1)	Offender C (1)	Offender D (1)	All offenders act as the information hub in the network. Thus, all of them are best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	4	Offender A (1)	Offender B (1)	Offender C (1)	Offender D (1)	All offenders act as the authority in the criminal group. Thus, all offenders are well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	4	Offender A	Offender B	Offender C	Offender D	The syndicate consists of one main clique, but can further be segregated into one smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	1	Offenders B, C & D	N/A	N/A	N/A	The syndicate consists of one main clique, but can further be segregated into one smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.923)	Offender C (0.923)	Offender D (0.923)	The measured values indicate that offender A is more central to the clique in terms of the overall network. Hence offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	4	Offender A (1)	Offender B (1)	Offender C (1)	Offender D (1)	The measured values indicate a high cohesiveness among all offenders, which possibly means that the friends of each offender are also friends with the other two members.
2.10	Least Integrated Offender in Group	0	Offender A (0.279)	Offender B (0.279)	Offender C (0.279)	Offender D (0.279)	All offenders use the same amount of cognitive effort to do its task in the group. Therefore, no offender could be judged as the least integrated offender.
2.11	Group Knowledge:	4	Offender A (0.250)	Offender B (0.250)	Offender C (0.250)	Offender D (0.250)	All offenders have the same level of group knowledge due to their exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	4	Offender A (0.5)	Offender B (0.5)	Offender C (0.5)	Offender D (0.5)	All offenders have equal workload in the syndicate based on the knowledge and resources used to perform their assigned tasks.

Table D.2.3: The Overall Crime Report for Case 3.
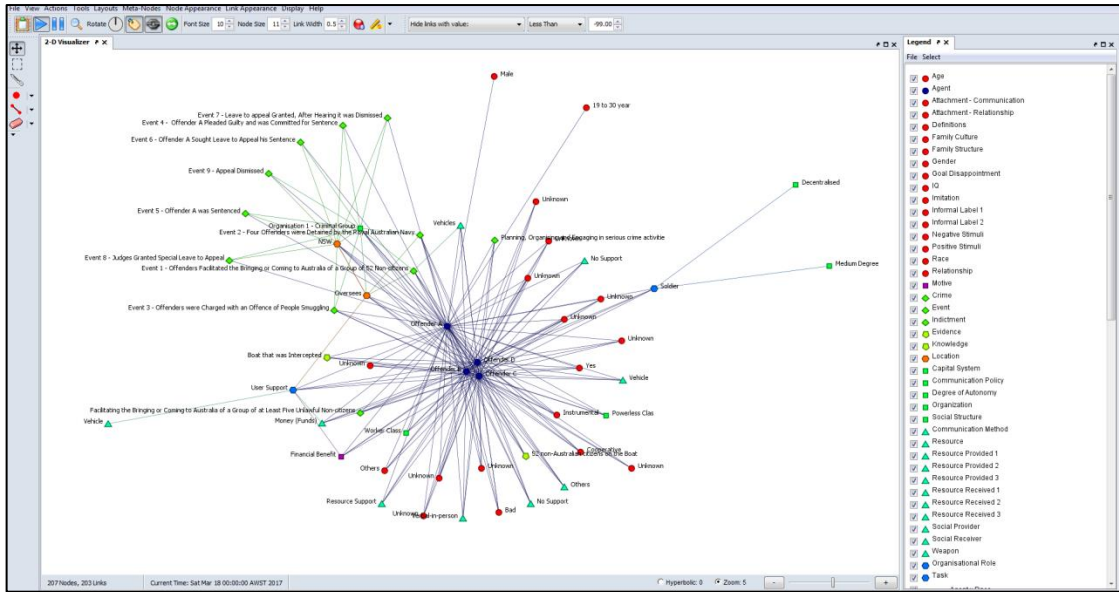
Figure D.2.3: Overall Network Diagram for Case 3.

D.2.4   Test Case Scenario Six: Case Study Four – Static Meta-Network

The next case under consideration is test case scenario six.   This scenario applies the
standard network analysis by utilizing the prototype to create a static meta-network of the
criminal group for the time period indicated in the court transcript.   Likewise, the
implementation methodology described in section 8.4.2 is executed, followed by the
compilation of the overall Crime Report (Table D.2.4) and capturing of a screenshot of the
overall Network Diagram (Figure D.2.4). The content of the table and Network Diagram are
referred to in section 8.6.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.003	0.003		
1.1.2	Std Dev	0	0.02	0.006		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0	0.212	0.039		
1.1.5	Sum Total	8	43	8		
1.1.6	Number of Nodes				204	
1.1.7	Number of Links				111	
1.1.8	Average Total Degree Centrality				0.003	
1.1.9	Average Clustering Coefficient for Network				0.134	

1.1.10	Network Centralisation				0.107	
1.1.11	Network Density				0.003	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.056	
1.1.14	Network Reciprocity				0.037	3.7% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A and B have a large percentage of the total degrees and the rest have relatively low degrees.

1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.003	111	0.54	1.232	
1.2.2	Core 2 Nodes (Offenders)	1	1	1	1	

1.3	**Overall Network Diagram:**	See Figure D.2.4

2	**_Overall Network Science Crime Analysis Report:_**				
		Total Applicable Nodes	**Measured Value**		
2.1	Emergent Leaders:	2	Offender A (0.254)	Offender B (0.254)	Based on the efforts to perform their tasks and connection with others, both offenders have been earmarked as the emergent leader and anyone could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)	There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	0	Offender A (0)	Offender B (0)	None of the offenders acts as the information hub in the network.
2.4	Authorities:	0	Offender A (0)	Offender B (0)	None of the offenders acts as the authority in the criminal group.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)	None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	2	Offender A	Offender B	The syndicate consists of one main clique and cannot be further segregated into smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	0	N/A	N/A	The syndicate consists of one main clique and cannot be further segregated into smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.984)	The measured values indicate that offender A is more central to the clique in terms of the overall network. Hence, offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	0	Offender A (0)	Offender B (0)	The measured value indicates a very low cohesiveness among offenders, which possibly means that the friends of each offender are not friends with the other offender.
2.10	Least Integrated Offender in	2	Offender A (0.254)	Offender B (0.254)	Both offenders use the same level of cognitive effort to do their task in the group.

	Group					
2.11	Group Knowledge:	2	Offender A (0.500)	Offender B (0.500)		Both offenders have similar levels of group knowledge due to their exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	2	Offender A (1.333)	Offender B (1.333)		Both offenders have similar workloads in the syndicate based on the knowledge and resources used to perform the assigned tasks.

Table D.2.4: The Overall Crime Report for Case 4.
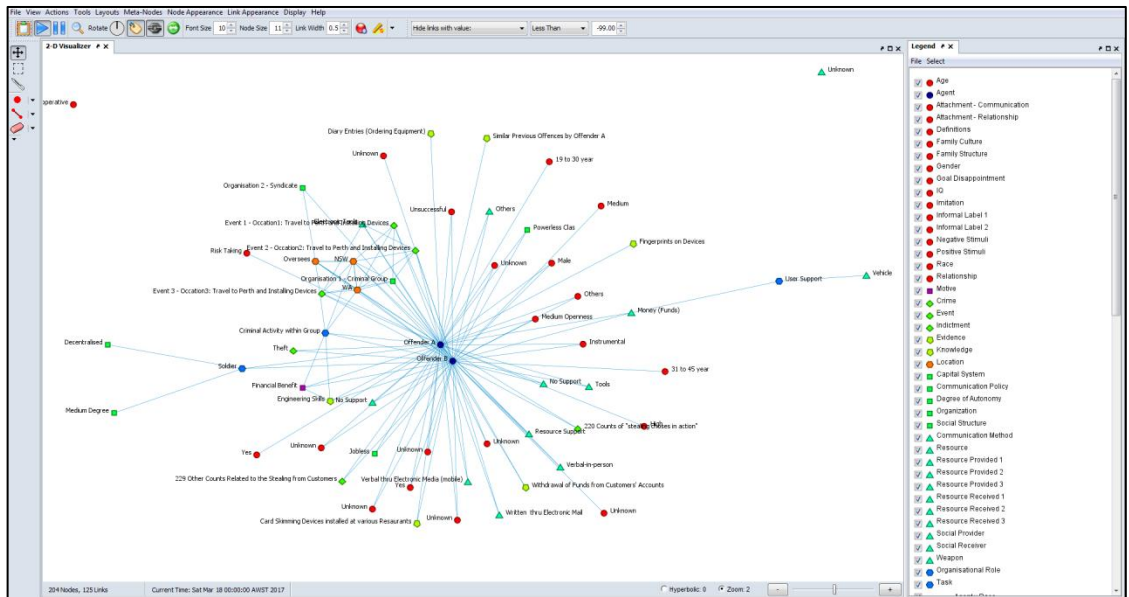
Figure D.2.4: Overall Network Diagram for Case 4.

D.2.5   Test Case Scenario Seven: Case Study Five – Static Meta-Network

Test case scenario seven is next computed and presented. As before, OCIPS is utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. After executing the implementation methodology, both the overall Crime Report (Table D.2.5) and overall Network Diagram (Figure D.2.5) were compiled. The content of the table and diagram are used in section 8.6 to supplement the discussion on the results acquired by means of the prototype.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.002	0.002		
1.1.2	Std Dev	0	0.015	0.006		
1.1.3	Minimum	0	0	0		

1.1.4	Maximum		0	0.205	0.052		
1.1.5	Sum Total		10	43	11		
1.1.6	Number of Nodes					211	
1.1.7	Number of Links					93	
1.1.8	Average Total Degree Centrality					0.002	
1.1.9	Average Clustering Coefficient for Network					0.019	
1.1.10	Network Centralisation					0.101	
1.1.11	Network Density					0.002	
1.1.12	Network Diameter					2	
1.1.13	Average Network Eigenvector Centrality					0.051	
1.1.14	Network Reciprocity					0.011	1.1% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution					Power	
1.1.16	Network Layout					Scale-Free	Offender A has 50% of the total degrees and the remaining nodes have relatively low degrees.

1.2	**Network Density**					
		Density	No of Links (Relationships)	Average Links per Remaining Nodes	Average Path Distance	
1.2.1	Entire Matrix	0.002	93	0.44	1.212	
1.2.2	Core 4 Nodes (Offenders)	0	0	0	0	

1.3	**Overall Network Diagram:**	See Figure D.2.5

2	***Overall Network Science Crime Analysis Report:***

		Total Applicable Nodes	Measured Value				
2.1	Emergent Leaders:	1	Offender A (0.132)	Offender B (0.112)	Offender C (0.112)	Offender D (0.112)	Based on the efforts to perform their respective tasks and connection with others, offender A has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	There is no connected group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	None of the offenders acts as the information hub in the network.
2.4	Authorities:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	None of the offenders acts as the authority in the criminal group.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)	Offender C (0)	Offender D (0)	None of offenders has significant level of influence in the syndicate.

2.6	No of Offenders in Main Clique:	0	N/A	N/A	N/A	N/A	The syndicate has no main clique.
2.7	No of Sub-Cliques in Syndicate:	0	N/A	N/A	N/A	N/A	The syndicate has no main clique.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.398)	Offender C (0.398)	Offender D (0.398)	The measured values indicate that offender A is more central to the clique in terms of the overall network. Hence, offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	3	Offender A (0)	Offender B (0.238)	Offender C (0.238)	Offender D (0.238)	The measured values indicate a high cohesiveness among offenders B, C & D; which possibly means that the friends of each offender are also friends with the other two offenders.
2.10	Least Integrated Offender in Group	3	Offender A (0.132)	Offender B (0.112)	Offender C (0.112)	Offender D (0.112)	Offenders B, C & D use the least cognitive effort to do their task in the group and can therefore being seen as the least integrated offenders.
2.11	Group Knowledge:	1	Offender A (0.294)	Offender B (0.235)	Offender C (0.235)	Offender D (0.235)	Offender A has the highest group knowledge due to his exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	1	Offender A (2.667)	Offender B (1.333)	Offender C (1.333)	Offender D (1.333)	Offender A has the highest workload in the syndicate based on the knowledge and resources used to perform the assigned tasks.

**Table D.2.5: The Overall Crime Report for Case 5.**
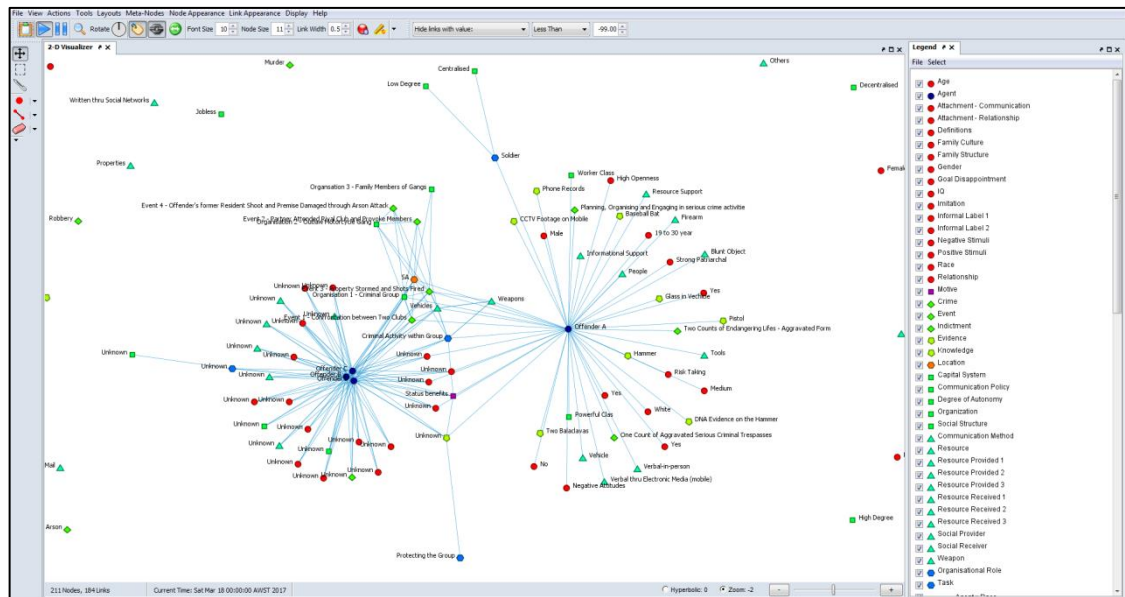
Figure D.2.5: Overall Network Diagram for Case 5.

### D.2.6 Test Case Scenario Eight: Case Study Six – Static Meta-Network

The next test case scenario of concern relates to test case six. For this test case scenario, the same standard network analysis as for the previous cases is also applied. A static meta-network of the criminal group in case study six is produced. Then, the implementation methodology described in section 8.4.2 is also executed, resulting in the production of the respective overall Crime Report (Table D.2.6) and overall Network Diagram (Figure D.2.6).

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.011	0.011		
1.1.2	Std Dev	0	0.044	0.021		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0.001	0.228	0.096		
1.1.5	Sum Total	43.544	50	21		
1.1.6	Number of Nodes				220	
1.1.7	Number of Links				552	
1.1.8	Average Total Degree Centrality				0.011	
1.1.9	Average Clustering Coefficient for Network				0.14	
1.1.10	Network Centralisation				0.122	
1.1.11	Network Density				0.011	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.127	
1.1.14	Network Reciprocity				0.074	7.4% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A, B and C have significant high degrees and the rest have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.011	552	2.51	1.327	
1.2.2	Core 12 Nodes (Offenders)	0.545	36	3	1.526	
1.3	**Overall Network Diagram:**	See Figure D.2.6				
2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable	**Measured Value**			

		Nodes				
2.1	Emergent Leaders:	2	Offender A (0.277), Offender D (0.244), Offender G (0.204), Offender J (0.144)	Offender B (0.272), Offender E (0.244), Offender H (0.215), Offender K (0.144)	Offender C (0.277), Offender F (0.244), Offender I (0.210), Offender L (0.144)	Based on the efforts to perform their tasks and connection with others, offenders A and C have been earmarked as the emergent leader in organisation 1 and could become the formal leader of the syndicate in the future. There is no explicit emergent leader in organisation 2.
2.2	Possible Boundary Spanners:	0	Offender A (0), Offender D (0), Offender G (0), Offender J (0)	Offender B (0), Offender E (0), Offender H (0), Offender K (0)	Offender C (0), Offender F (0), Offender I (0), Offender L (0)	There is only one group in each organisation which has no ties with the other group. Therefore, no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (0.945), Offender D (0.512), Offender G (0.429), Offender J (1)	Offender B (0.512), Offender E (0.512), Offender H (0.840), Offender K (1)	Offender C (1.0), Offender F (0.512), Offender I (0.354), Offender L (1)	Offender C acts as the information hub in organisation 1. Thus, he is best placed to send out information to the other offenders in organisation 1. There is no clear information hub in organisation 2, as all members serve as information hubs.
2.4	Authorities:	1	Offender A (1), Offender D (0.728), Offender G (0.548), Offender J (1)	Offender B (0.728), Offender E (0.728), Offender H (0.728), Offender K (1)	Offender C (0.756), Offender F (0.728), Offender I (0.548), Offender L (1)	Offender A acts as the authority in organisation 1. Thus, offender A is well placed to receive information from all other offenders. There is no explicit authority in organisation 2.
2.5	Possible Influential Individuals:	1	Offender A (0), Offender D (0.020), Offender G (0.001), Offender J (0)	Offender B (0.020), Offender E (0.020), Offender H (0), Offender K (0)	Offender C (0), Offender F (0.020), Offender I (0.024), Offender L (0)	Offender I has the highest level of influence in the organisation 1. Offenders J, K & L have the same level of influence in organisation 2.
2.6	No of Offenders in Main Clique:	9 X 1, 3 X 1	Offender A, Offender D, Offender G, Offender J	Offender B, Offender E, Offender H, Offender K	Offender C, Offender F, Offender I, Offender L	Each organisation encompasses one main clique, but can further be segregated into smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	8 X 1, 1 X 1	Offenders A, B, C, D, E, F, & G; Offenders A, B & C; Offenders B, D, E, F & I	Offenders A, B, C, D, E, F, & H; Offenders A & C; Offenders B, D, E, F, & G	Offenders A, B, C, D, E, F, & I; Offenders B, C, D, E, F, & H; Offenders J, K, & L	Organisation 1 could be segregated into eight smaller sub-cliques and organisation 2 into at least one.
2.8	Offender Eigenvector Centrality:	1	Offender A (0.962), Offender D (0.987), Offender G (0.878), Offender J (0.611)	Offender B (1), Offender E (0.990), Offender H (0.919), Offender K (0.611)	Offender C (0.989), Offender F (0.982), Offender I (0.909), Offender L (0.595)	The measured values indicate that offender B is more central to both outlaw gangs in terms of the overall network and offender L is the least centred. Hence, offender B is the most important member in both gangs.
2.9	Offender Clustering Coefficient:	6	Offender A (0.893), Offender D (0.893), Offender G (1), Offender J (1)	Offender B (0.893), Offender E (0.893), Offender H (1), Offender K (1)	Offender C (0.893), Offender F (0.893), Offender I (1), Offender L (1)	The measured values indicate a high cohesiveness among offenders G, H & I, as well among offenders J, K & L. This possibly means that the friends of each group of offenders are also friends with the other two members in that group.
2.10	Least Integrated Offender in	1	Offender A (0.277), Offender D (0.244),	Offender B (0.272), Offender E	Offender C (0.277), Offender F	Offender G uses the least cognitive effort to do its task in organisation 1 and can therefore being seen as the least integrated offender for

	Group		Offender G (0.204), Offender J (0.144)	(0.244), Offender H (0.215), Offender K (0.144)	(0.244), Offender I (0.210), Offender L (0.144)	organisation 1. All offenders in organisation 2 use the same amount of cognitive effort to perform their tasks.
2.11	Group Knowledge:	4	Offender A (0.162), Offender D (0.089), Offender G (0.066), Offender J (0.038)	Offender B (0.089), Offender E (0.089), Offender H (0.107), Offender K (0.038)	Offender C (0.134), Offender F (0.089), Offender I (0.060), Offender L (0.038)	Offender A has the most group knowledge due to his exclusive ties with other entities within organisation 1. Offenders J, K & L have equal group knowledge in organisation 2.
2.12	Overall Workload:	6	Offender A (1.667), Offender D (1.333), Offender G (1.333), Offender J (1.333)	Offender B (1.333), Offender E (1.333), Offender H (1.667), Offender K (1.333)	Offender C (1.667), Offender F (1.333), Offender I (1.333), Offender L (1.333)	Offenders A, C & H have the highest workload in the organisation 1 based on the knowledge and resources used to perform the assigned tasks. Offenders J, K & L have similar workloads in organisation 2.

Table D.2.6: The Overall Crime Report for Case 6.

Figure D.2.6: Overall Network Diagram for Case 6.

D.2.7   Test Case Scenario Nine: Case Study Seven – Static Meta-Network

Next, test case scenario nine is executed by applying the standard network analysis technique. OCIPS is utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. The implementation methodology described in section 8.4.2 is also executed, and the corresponding results are presented in the overall Crime Report (Table D.2.7) and overall Network Diagram (Figure D.2.7). The content of the

table and diagram are used in section 8.6 to augment the discussion on the results acquired by means of the prototype.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.001	0.001		
1.1.2	Std Dev	0	0.014	0.004		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0	0.192	0.044		
1.1.5	Sum Total	8	39	9		
1.1.6	Number of Nodes				204	
1.1.7	Number of Links				59	
1.1.8	Average Total Degree Centrality				0.001	
1.1.9	Average Clustering Coefficient for Network				0.024	
1.1.10	Network Centralisation				0.096	
1.1.11	Network Density				0.001	
1.1.12	Network Diameter				2	
1.1.13	Average Network Eigenvector Centrality				0.038	
1.1.14	Network Reciprocity				0	0% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offender A has about 55% of the total degrees and the rest have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.001	59	0.29	1.157	
1.2.2	Core Node (Offender)	0	0	0	0	
1.3	**Overall Network Diagram:**	**See Figure D.2.7**				
2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable Nodes	**Measured Value**			
2.1	Emergent Leaders:	1	Offender A (0.079)			Based on the efforts to perform his tasks, Offender A might become emergent leader in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)			Offender A is the only member of the group of which information was available; therefore, no concurrent membership could be calculated.
2.3	Hubs:	0	Offender A (0)			Offender A is the only member of the group of which information was available; therefore, no inference regarding information hub in the network could be concluded.
2.4	Authorities:	0	Offender A (0)			Offender A is the only member

					of the group of which information was available; therefore, no inference regarding authority centralisation in the network could be concluded.
2.5	Possible Influential Individuals:	0	Offender A (0)		Offender A is the only member of the group of which information was available; therefore, no level of influence in the syndicate could be calculated.
2.6	No of Offenders in Main Clique:	0	Offender A		Offender A is the only member of the group of which information was available; therefore, no cliques could be calculated.
2.7	No of Sub-Cliques in Syndicate:	0	N/A		Offender A is the only member of the group of which information was available; therefore, no cliques could be calculated.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)		Based on the limited information, the measured values indicate that offender A could be central to the clique in terms of the overall organisation; however, no information exists on the other offenders to confirm inference.
2.9	Offender Clustering Coefficient:	0	Offender A (0)		Offender A is the only known offender and therefore no inference could be made regarding cohesiveness among offenders.
2.10	Least Integrated Offender in Group	1	Offender A (0.079)		Offender A is the only member of the group of which information was available; therefore, no clear inference could be made in terms of least integrated offender.
2.11	Group Knowledge:	1	Offender A (1)		Based on the limited information, offender A has the highest group knowledge.
2.12	Overall Workload:	0	Offender A (0)		Workload for offender A could not be determined as not enough information is available in terms of knowledge and resources used to perform the assigned tasks.

Table D.2.7: The Overall Crime Report for Case 7.

Figure D.2.7: Overall Network Diagram for Case 7.

D.2.8 Test Case Scenario Ten: Case Study Eight – Static Meta-Network

Test case scenario ten is developed to analyse case study eight. For this scenario, OCIPS is utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. The derived output for executing the test case scenario is summarised in the overall Crime Report (Table D.2.8) and the overall Network Diagram (Figure D.2.8). The content of the table and diagram are further discussed in section 8.6.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.004	0.004		
1.1.2	Std Dev	0	0.026	0.007		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0.1	0.246	0.044		
1.1.5	Sum Total	32	50	9		
1.1.6	Number of Nodes				204	
1.1.7	Number of Links				163	
1.1.8	Average Total Degree Centrality				0.004	
1.1.9	Average Clustering Coefficient for Network				0.177	
1.1.10	Network Centralisation				0.125	
1.1.11	Network Density				0.004	
1.1.12	Network Diameter				3	
1.1.13	Average Network Eigenvector Centrality				0.069	
1.1.14	Network Reciprocity				0.058	5.8% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A, B and C have about 70% of the total degrees and the rest have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.004	163	0.8	1.331	
1.2.2	Core 3 Nodes (Offenders)	1	3	1	1.667	
1.3	**Overall Network Diagram:**	**See Figure D.2.8**				
2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable Nodes	**Measured Value**			

2.1	Emergent Leaders:	1	Offender A (0.298)	Offender B (0.237)	Offender C (0.237)	Based on the efforts to perform their tasks and connection with others, offender A has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)	Offender C (0)	There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (1)	Offender B (0.843)	Offender C (0.843)	Offender A acts as the information hub in the network. Thus, he is best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	1	Offender A (1)	Offender B (0.843)	Offender C (0.843)	Offender A acts as the authority in the criminal group. Thus, offender A is well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)	Offender C (0)	None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	3	Offender A	Offender B	Offender C	The syndicate consists of one main clique, but can further be segregated into three smaller sub-cliques.
2.7	No of Sub-Cliques in Syndicate:	3	Offenders A & B	Offenders A & C	Offenders B & C	The syndicate consists of one main clique, but can further be segregated into three smaller sub-cliques.
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.904)	Offender C (0.870)	The measured values indicate that offender A is more central to the clique in terms of the overall network and offender C is the least centred. Hence, offender A is the most important member in the main clique.
2.9	Offender Clustering Coefficient:	3	Offender A (1)	Offender B (1)	Offender C (1)	The measured values indicate a high cohesiveness among all offenders, which possibly means that the friends of each offender are also friends with the other two offenders.
2.10	Least Integrated Offender in Group	2	Offender A (0.298)	Offender B (0.237)	Offender C (0.237)	Offenders B and C use the least cognitive effort to do its task in the group and can therefore being seen as the least integrated offender.
2.11	Group Knowledge:	1	Offender A (0.401)	Offender B (0.299)	Offender C (0.299)	Offender A has the highest group knowledge due to his exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	1	Offender A (3)	Offender B (1)	Offender C (1)	Offender A has the highest workload in the syndicate based on the knowledge and resources used to perform the assigned tasks.

Table D.2.8: The Overall Crime Report for Case 8.

Figure D.2.8: Overall Network Diagram for Case 8.

D.2.9 Test Case Scenario Eleven: Case Study Ten – Static Meta-Network

This test case scenario is grounded on case study ten and applies the standard network analysis technique. The prototype is used to create a static meta-network of the criminal group for the case study and produced both the overall Crime Report (Table D.2.9) and the overall Network Diagram (Figure D.2.9). The content of the table and diagram are further articulated in section 8.6.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	**Out-Degree**	**In-Degree**	**Overall Network Value**	
1.1.1	Mean	0	0.003	0.003		
1.1.2	Std Dev	0	0.019	0.006		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0	0.194	0.045		
1.1.5	Sum Total	9.833	39	9		
1.1.6	Number of Nodes				202	
1.1.7	Number of Links				104	
1.1.8	Average Total Degree Centrality				0.003	
1.1.9	Average Clustering Coefficient for Network				0.127	
1.1.10	Network Centralisation				0.098	
1.1.11	Network Density				0.003	
1.1.12	Network Diameter				2	
1.1.13	Average Network Eigenvector Centrality				0.059	

1.1.14	Network Reciprocity				0.03	3% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A and B have about 75% of the total degrees and the rest have relatively low degrees.
1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.003	104	0.52	1.262	
1.2.2	Core 2 Nodes (Offenders)	1	1	0.5	1	
1.3	**Overall Network Diagram:**	**See Figure D.2.9**				
2	***Overall Network Science Crime Analysis Report:***					
		Total Applicable Nodes	**Measured Value**			
2.1	Emergent Leaders:	2	Offender A (0.229)	Offender B (0.229)		Based on the efforts to perform their tasks and connection with others, both offenders could become the emergent leader and then become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)		There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	0	Offender A (0)	Offender B (0)		None of the offenders acts as the information hub in the network.
2.4	Authorities:	0	Offender A (0)	Offender B (0)		None of the offenders acts as the authority in the criminal group.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)		None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	2	Offender A	Offender B		The syndicate consists of one main clique and cannot further be segregated into smaller sub-cliques (Two offenders only).
2.7	No of Sub-Cliques in Syndicate:	0	N/A	N/A		The syndicate consists of one main clique and cannot further be segregated into smaller sub-cliques (Two offenders only).
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.974)		The measured values indicate that offender A is more central to the clique in terms of the overall network. Hence, offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	0	Offender A (0)	Offender B (0)		The measured values indicate a relative low cohesiveness among offenders, which possibly means that the friends of each offender are not friends with the other member.
2.10	Least Integrated Offender in Group	2	Offender A (0.229)	Offender B (0.229)		Both offenders use the same level of cognitive effort to do its task in the group.
2.11	Group Knowledge:	2	Offender A (0.500)	Offender B (0.500)		Both offenders possess the same level of group knowledge due to their exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	0	Offender A (0)	Offender B (0)		No workload could be calculated due to the lack of sufficient information on knowledge and resources.

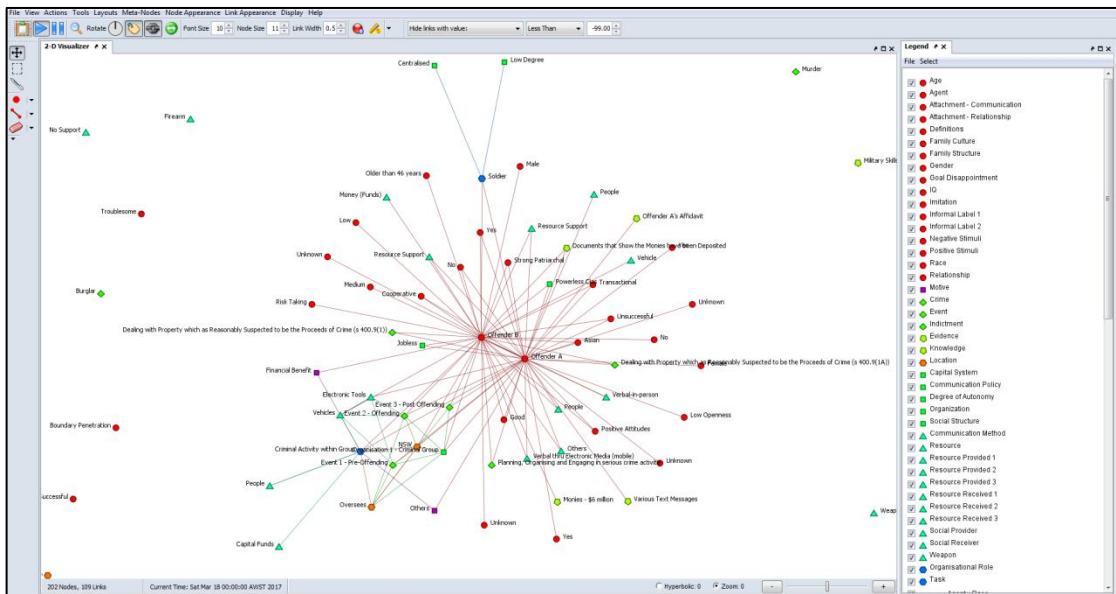**Table D.2.9: The Overall Crime Report for Case 10.**

Figure D.2.9: Overall Network Diagram for Case 10.

D.2.10   Test Case Scenario Twelve: Case Study Eleven – Static Meta-Network

The final test case scenario developed and analysed for this project is based on case study eleven. As for the other eleven test cases, OCIPS is utilized to create a static meta-network of the criminal group for the time period indicated in the court transcript. The end result of processing the meta-network is the overall Crime Report (Table D.2.10) and the overall Network Diagram (Figure D.2.10). As for the other eleven case scenarios, the content of the table and diagram is also discussed further in section 8.6.

Ref No.	Measure Description	Computed Results				Remarks
1	*OVERALL NETWORK STATISTICS REPORT:*					
1.1	**Descriptive Statistics for Centrality Measures**					
		Betweenness	Out-Degree	In-Degree	Overall Network Value	
1.1.1	Mean	0	0.002	0.002		
1.1.2	Std Dev	0	0.014	0.004		
1.1.3	Minimum	0	0	0		
1.1.4	Maximum	0	0.156	0.03		
1.1.5	Sum Total	9	31	6		
1.1.6	Number of Nodes				200	
1.1.7	Number of Links				69	
1.1.8	Average Total Degree Centrality				0.002	
1.1.9	Average Clustering Coefficient for Network				0.082	
1.1.10	Network Centralisation				0.079	
1.1.11	Network Density				0.002	

1.1.12	Network Diameter				2	
1.1.13	Average Network Eigenvector Centrality				0.078	
1.1.14	Network Reciprocity				0.015	1.5% of all the links (relationships) are reciprocal.
1.1.15	General Degree Distribution				Power	
1.1.16	Network Layout				Scale-Free	Offenders A and B have about 60% of the total degrees and the rest of the nodes have relatively low degrees.

1.2	**Network Density**					
		Density	**No of Links (Relationships)**	**Average Links per Remaining Nodes**	**Average Path Distance**	
1.2.1	Entire Matrix	0.002	69	0.35	1.207	
1.2.2	Core 2 Nodes (Offenders)	1	1	0.5	2	

1.3	**Overall Network Diagram:**	See Figure D.2.10				

2	*Overall Network Science Crime Analysis Report:*					
		Total Applicable Nodes	**Measured Value**			
2.1	Emergent Leaders:	1	Offender A (0.279)	Offender B (0.229)		Based on the efforts to perform their tasks and connection with others, offender A has been earmarked as the emergent leader and could become the formal leader of the syndicate in the future.
2.2	Possible Boundary Spanners:	0	Offender A (0)	Offender B (0)		There is only one group in the syndicate, therefore no offender has concurrent membership in overlapping groups and acts as Boundary Spanners.
2.3	Hubs:	1	Offender A (1)	Offender B (0.500)		Offender A acts as the information hub in the network. Thus, she is best placed to send out information to the other offenders in the syndicate.
2.4	Authorities:	1	Offender A (1)	Offender B (0.500)		Offender A acts as the authority in the criminal group. Thus, offender A is well placed to receive information from all other offenders.
2.5	Possible Influential Individuals:	0	Offender A (0)	Offender B (0)		None of offenders has significant level of influence in the syndicate.
2.6	No of Offenders in Main Clique:	1	Offender A	Offender B		The syndicate consists of one main clique and cannot further be segregated into smaller sub-cliques (Two known offenders only).
2.7	No of Sub-Cliques in Syndicate:	0	N/A	N/A		The syndicate consists of one main clique and cannot further be segregated into smaller sub-cliques (Two known offenders only).
2.8	Offender Eigenvector Centrality:	1	Offender A (1)	Offender B (0.804)		The measured values indicate that offender A is more central to the clique in terms of the overall network. Hence, offender A is the most important member in the clique.
2.9	Offender Clustering Coefficient:	1	Offender A (1)	Offender B (0)		The measured values indicate that offender B's friends are also friends with offender A. To the contrary, offender A's friends are not friends with offender B.
2.10	Least Integrated Offender in Group	1	Offender A (0.279)	Offender B (0.229)		Offender B uses the least cognitive effort to do its task in the group and can therefore being seen as the least integrated offender.

2.11	Group Knowledge:	1	Offender A (0.680)	Offender B (0.320)		Offender A has the highest group knowledge due to her exclusive ties with other entities within the syndicate.
2.12	Overall Workload:	0	Offender A (0)	Offender B (0)		Workload for both offenders could not be determined as not enough information is available in terms of knowledge and resources used to perform the assigned tasks.

Table D.2.10: The Overall Crime Report for Case 11.

Figure D.2.10: Overall Network Diagram for Case 11.