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THE IMPACT OF DISRUPTIVE TECHNOLOGIES ON DESIGNATED ORGANISATIONS WITHIN THE IT INDUSTRY IN SOUTH AFRICA

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ABSTRACT

Title:	THE IMPACT OF DISRUPTIVE TECHNOLOGIES ON DESIGNATED ORGANISATIONS WITHIN THE IT INDUSTRY IN SOUTH AFRICA
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Disruptive Technologies can assist an organisation to maintain a competitive advantage in the marketplace. Different terminology is used in the literature to describe disruptive technologies associated with uncertainty and risk. The term “disruptive technologies” is described and explained in comparison to sustaining technology. The aim of the research is to determine the impact of disruptive technologies on the ICT environment of an organisation. The impact of disruptive technology is discussed in terms of the business value of information technologies, the value network of the organisation, the current security framework of the information technology architecture, business processes and standards, approaches to business strategy, involvement of executive management and influence on customers and clients of the organisation. Three organisations within the South African environment agreed to be the subjects of the case studies. These were described and recommendations were made at the completion of the research.

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Abbreviations

S/no	Abbreviation	Description
A	B	C
1.	CMMI	Capability Maturity Model for Innovation
2.	ERM	Enterprise Risk Management
3.	ICT	Information Communication Technology
4.	IT	Information Technology
5.	PDA	Personal Digital Assistants
6.	R&D	Research and Development
7.	VoIP	Voice over Internet Protocol

Privacy Information

The researcher has received clearance from the Faculty Committee for Research Ethics and Integrity at the University of Pretoria to execute the case studies with the purpose of completing the research.

The three organisations that took part in the case studies are referred to as organisation A, B and C. The interviews are available on tape for reference purposes.

1. Introduction and structure

1.1 Introduction

There is an ongoing race in the digital economy to find better, faster and more efficient technologies to support the value chain of any given organisation. The information technology platform should both effectively support the organisation and simultaneously seek innovative technologies that will give the organisation a competitive advantage within a specific industry marketplace. However, when disruptive technologies enter the industry marketplace, the potential to change the business landscape is increased (Patki, 2006:18). Organisations can use disruptive technology to maintain a competitive advantage or risk losing business through their reluctance to use the new technology.

Organisations realised the importance of information technology and the role it plays in maintaining a competitive advantage. At the same time, however, investing in innovative technologies can also have a risk implication to the operation of an organisation. The dilemma the organisation faces is threefold: when to invest in new technologies that could disrupt the organisational operations; when to embrace an endeavour with uncertain results; and how to manage uncertainties in terms of developments in information technology.

Organisations face enormous pressure to stay current in terms of innovative technology and simultaneously to maintain their competitive advantage. Organisations constantly need to perform based on the following issues:

- Locate the right information at the right time for the right audience to support the management information of the organisation;
- Stay abreast of business and technology trends;
- Provide better products and services to be profitable; and
- Maintain communication and build trust among peers.

Information technology has become central to business and society, and the success of a firm has become increasingly dependent on how the firm will be

transformed by disruptive technology (Dhar & Sundararajan, 2007:126). In the new digital economy, business is faced with new technological challenges such as the following:

- Data, information and knowledge may come in a structured, semi-structured or unstructured form and in various formats (hard copy, video, picture, texts, voice message, etc.) (Dhar & Sundararajan, 2007:126);
- Data, information and knowledge can be received at any point in time.
- The unpredictability of the volume of data, or information or knowledge increase the risk of maintaining information technology support;
- Storage of information is another dilemma organisations have to face. The organisation has to ensure that different electronic devices will be able to handle new technologies;
- Innovative technologies could be able to integrate with in-use technologies, but it could also be too innovative to integrate with current technologies (Tsui, 2001: 5).

From the business perspective it is becoming vital that innovative technologies provide enough detail and information regarding the potential the technology hold for the organisation in terms of increased productivity, performance delivery and adding value to the business and business society (Dhar & Sundararajan, 2007:125). The success of a business is increasingly based on the value that information technology is adding (Evans, 2003:8), however businesses should apply IT creatively and effectively to address the practical technology needs of a business. IT continuously transforms the operational or organisational excellence of a business (Dhar & Sundararajan, 2007:126) and there is a growing concern amongst management regarding the inability to make decisions on implementing disruptive technology. The complexity of disruptive technology may have serious consequences not only on individual organisational strategies and the execution of operations, but also on the global society. Therefore, Information

Communication Technology (ICT) should take the influence of big companies and government organisations into consideration because these are the largest consumers of ICT (Cornford & Smithson, 2003:15).

1.2 Statement of the Problem

Information technology is the enabler that supports the core business of an organisation (Evans, 2003:2). However it is important to establish the best information technology solution that not only supports the goals and operations of an organisation but also holds the potential to give the organisation a competitive advantage. It is usually difficult to define whether or not an innovative technology will, in fact, become a disruptive technology. The statement of the problem entails that companies do not know when a disruptive technology can potentially provide a competitive advantage or not. The hypothesis proposed is that organisations are aware of disruptive or innovative technologies, and the potential competitive advantage that may be achieved if the information technology is utilised efficiently.

The main focus of this study is to determine the impact of disruptive technology in the ICT environment and how new technologies can be managed in a secured architecture framework of organisations in the banking sector. Furthermore, the purpose of the research is to provide insight and principles when companies need to make informative decisions when to implement a disruptive technology.

Sub-problems arise from the main problem, and can be addressed using the following questions:

- Are organisations aware of disruptive technology and how is disruptive technology handled?
- What is the business value of disruptive technology?
- Will the disruptive technology have an impact on the in-use computer systems?

- Will the in-use hardware and software architecture be able to accommodate the new technology?
- Will the disruptive technology have an impact on organisational business processes and procedures?
- What is the relationship between the services provided by an organisation, which is supported with information technology, and the customers/clients of the organisation?
- How will the disruptive technology influence the security and control of the information of an organisation?
- Does the information technology business strategy make provision for disruptive technology and how is it managed?

1.3 Main aim of the mini-dissertation

The main aim of this mini-dissertation is to determine the impact of disruptive technology on organisations within the information technology industry in the South African context.

1.4 Methodology

The research endeavour will use an empirical research approach as discussed by Cornford and Smithson (2003:43). Empirical research tends to observe events that are particularly described in its procedures, precise in measurements, rather than presenting generalised assumptions. Within the empirical framework the idiographic style of research will be used for the case study.

The idiographic research style includes the “exploring of cases or events with the aim to understand a phenomenon” (Cornford & Smithson, 2003:43) in its own context. The aim of this study as described in the problem statement is to identify new technology as disruptive technology and how to manage the event. A case

study will be undertaken to understand disruptive technology as a phenomenon in the context of a specific organisation.

The goal of the case study is “to learn from the current situation in real life” (Olivier, 2004:10). The case study will focus on qualitative results supported by descriptive statements. The case study will be based on three organisations. The only foreseeable constraint on the successful completion of the study is the time dimension that often influences case studies.

1.4.1 Literature Survey

A literature survey will provide the theoretical framework against which the study will be completed referring to relevant information that has been published previously. A literature survey has been conducted to establish the occurrence of the concept in the academic arena.

1.4.2 Case study

A case study will be performed with the intention to establish how an organisation has managed the impact of a disruptive technology. From the information gathered and lessons learnt from the case study, recommendations will be made.

1.5 Outline of the scope

Disruptive technology can have an impact on the business community as well as the social community. This research will focus on the business community in the South African context. Disruptive technology is applicable to different types of businesses, such as engineering, medical industry, or manufacturing. The scope of the research is limited to the business sector, and particularly the information technology departments within organisations that are responsible for the support and implementation of information technology. The study is narrowed down to specifically the information technology section within the banking sector, which is responsible for the implementation technology infrastructure of the organisation.

The scope of the research document will include the following:

- Literature study and background

- Research methodology
- Research results
- Conclusions and recommendation

The scope of the research excludes the following:

- Detailed description of the change management process;
- Business sectors other than the banking industry;
- Information technology strategic management;
- Risk management.

2. Literature study on the background of disruptive technologies

2.1 Introduction

A brief historical overview of the development, implementation and utilisation of information technology in the business arena and how it was applied, gives a holistic perceptive of the purpose of using information technology and the approach management took to incorporate the technology into business. In the early years information technology was used for specific purposes and only highly skilled users were able to utilise it effectively. As technology developed and software applications became more user-friendly, management was enabled to take control of these resources, which include hardware, software and skilled information technology resources (Evans, 2003:xxii).

When IBM introduced the personal computer in 1984, management could not foresee the dramatic impact of this new technology on business. Personal computers enabled firms to become less dependent on IT companies. Information technology became a new corporate investment in terms of products and training of staff. With the further development of intranet and Internet availability, information technology became embedded in the nature of doing business. Firms had to develop an organisational IT architecture to support distributed technologies, staff and users in the global environment. The dot-com era provided an electronic commerce functionality and organisations realised the importance of applying new technology to create a competitive advantage. The dot-com era enabled connectivity between organisations, supported devices for communication by using laptop computers, Internet appliances, mobile phones and personal digital assistants (PDA's).

This overview of the development of information technology clearly shows that management is challenged every time a new technology is launched. Disruptive technology has the tendency of challenging or transforming the "current way of doing things" (Jones & Smith, 2005:19). The World Wide Web functionality required management to revisit or change IT models to adapt new ways of

applying and managing IT. It may be concluded that change is inevitable and that; any firm has to adapt to be able to incorporate a new technology to maintain a competitive advantage.

Information technology (IT) is beneficial to businesses in terms of improved productivity, support to business processes and investing in technologies. Businesses should realise that IT is central and provides a mediating role, which supports interaction between firms, consumers and customers (Dhar & Sundararajan, 2007:125). IT governance focuses on information technologies that deliver what is promised and business is following the back-to-basic approach which aims to balance IT costs and performance improvement. Therefore it becomes important to grasp the business value of new technologies – whether or not impact of new technology will actually enable the organisation or firm to reshape their business to achieve results, if it will support profitability or if it will provide the business value for investment.

Business approaches information technology from different angles and with various objectives, such as:

- Productivity must be improved;
- Costs must be reduced;
- Revenues could be increased;
- Shareholder value can be increased;
- Customer loyalty and satisfaction can be increased
- Reduction of risks and pitfalls.

In the information technology era businesses are looking for emerging and disruptive technologies that will provide a source of growth and will enable competitive advantage. Therefore it is important for organisations to have insight into disruptive technologies to establish if the technology will create enterprise value, increase competitive advantage and business agility (Evans, 2003:xxi). Kassicieh *et al.* (2002a:668) reached the conclusion that firms are usually more

successful when they use a system architecture, consisting of a combination of disruptive and sustaining technology.

When evaluating disruptive technology, the risk of implementing it must be taken into consideration. Therefore, to undertake a study to understand disruptive technology would provide knowledge on how to approach disruptive technology in the business's strategic planning, to manage possible risks effectively and to reap the benefit of the return on investment (Evans, 2003:xxv). The purpose of this study is to understand disruptive technologies and the impact they could have on organisations. For the purpose of this study, the term organisation should be understood to refer to a business that uses information technology, for example banks, food suppliers, retailers, etc.

2.2 Defining disruptive technologies

A number of definitions of disruptive technology can be found in the literature. In this paper, definitions were selected to reflect the concept in the information technology environment.

In the last half century, technology has become an integral part of the day-to-day running of a business, mainly by supporting people to complete the necessary tasks to make the company profitable and successful. The drive to improve performance, to be more profitable or to provide a better service to the client often fuels the need to change and improve technology. The business environment relies on technology development to support the firm's need to become more profitable, to attain and maintain a competitive advantage over their competitors.

It is inevitable that innovative information technology will be developed with the sole purpose of providing a tool that will enable businesses to excel. The innovation could be of such a dramatic nature that it will result in the disruption of the standard business procedures and even the culture of the business.

Christensen and Bower (1995:10) define disruptive technology as “innovations that create an entirely new market through the introduction of a new kind of service or product”. This definition implies that disruptive technology is an innovation that will lead to a totally new way of doing things, how people work and how a firm runs its business. The definition can be applied to the economic environment where new technologies may influence the entire digital economy environment in an unexpected manner. Christensen, in various articles, described how companies failed because they did not include new technology in their operational framework. Disruptive technologies create new challenges and changes to the organisation which could be used to the benefit of the organisation.

Technologies are not only applied to support the business procedures of an organisation but to provide a basis for competitive advantage. Kassicieh *et al.* (2002a:375) define disruptive technologies as “scientific discoveries that break through the usual product/technology capabilities and provide a basis for a new competitive paradigm”. Technologies enable a firm to be more competitive, secure more business, produce faster, work better and keep the customer satisfied. Disruptive technologies have the potential to create a new marketplace and in consequence make other industries redundant (Tsui, 2001:3).

Disruptive technology is defined by Daneels (2004:247) as “a specific type of technological change, which operates through a specific mechanism, and has specific consequences”. Daneels looked critically at the concept “disruptive technology” to establish when a technology may be deemed “disruptive” or if “disruptiveness” is implied when new technology is implemented. Further Daneels defines disruptive technology as “technology that changes the basis of competition by changing the performance metrics along which firms compete” (Daneels, 2004:249). Technology per se is not disruptive, but it becomes disruptive when it exceeds the performance of technology that is currently in use.

Disruptive technology is also described as risky because it challenges current technologies and is difficult to recognise especially in the early development stages (Jones, 2005:19). Therefore disruptive technology is a threat to market incumbents because market surveys do not always present the new technology as a serious technology that could move successfully into the upper-market.

Disruptive technology may also be described as technology of “radical change”. Other terms used to describe disruptive technology are “radical innovations” or “discontinuous innovation”, which implies that radical new technology displaces current technology and processes to provide competitive advantage (Kaplan, 1999:16). “Discontinuous innovation refers to radically new products (technologies) that involve dramatic leaps in terms of customer familiarity and use” (Veryzer, 1998:305).

Clark (2003:30) discusses other concepts which are similar to disruptive technology and defines disruptive technology as “innovation diffusion” (the action of spreading over a wide area). Innovation diffusion suggests that when a new technology is implemented in a section of a firm, the implementation will not only have an effect on other departments or business units within the firm, but also on other firms with which the firm interacts via information technology within the business environment (Clark, 2003: 30).

To understand disruptive technologies, the concept “sustaining technologies” must also be examined. Christensen (2000: xv) describes sustaining technologies as technologies that “foster improved product performance”. This implies that established products can be incremental in nature. “Sustaining technologies create innovations that are modifications of, or improvements to, or replacements for existing products” currently used within the firm (Walsh & Kirchhoff, 2000:322). Walsh and Kirchhoff also use the term “evolutionary technology” as a synonym to sustaining technology. Businesses use information technologies for different purposes within the same firm. These information technologies are updated and enhanced to improve functionality, increase

profitability and increase other benefits of the firm. These information technologies provide the mainstream system architecture within a firm. Enhancing the mainstream information technology implies that the technology is sustained.

Sustaining technology can be described as successive versions which upgrade the system with improvements to enhance performance that market leaders incorporate into their current systems. To improve product performance, incremental technologies have a lifecycle of “continuous innovations” which do not alter markets (as disruptive technologies do), but develop information technology improvements in existing products as requested by users (Walsh & Kirchhoff, 2000:322).

Companies developing new technology seek input from end-users to establish the level of usability of the product (Lasry, 2004:19). However end-users who demand new or disruptive technologies may actually have a negative effect on the performance of the information technology architecture of an organisation (Lasry, 2004:1).

The term “incremental technology” contains the same nuance as sustaining technology in the sense that it is used to describe technology that is used to support the well-practised technology capabilities already established in a firm. The technological changes are not radical and the firm incorporates technological changes smoothly into the business procedures and culture of the business.

2.3 Model to describe disruptive technologies

Below is a model presenting a relevant description and providing insight into the concept disruptive technologies used by Walsh and Kirchhoff (2000:321):

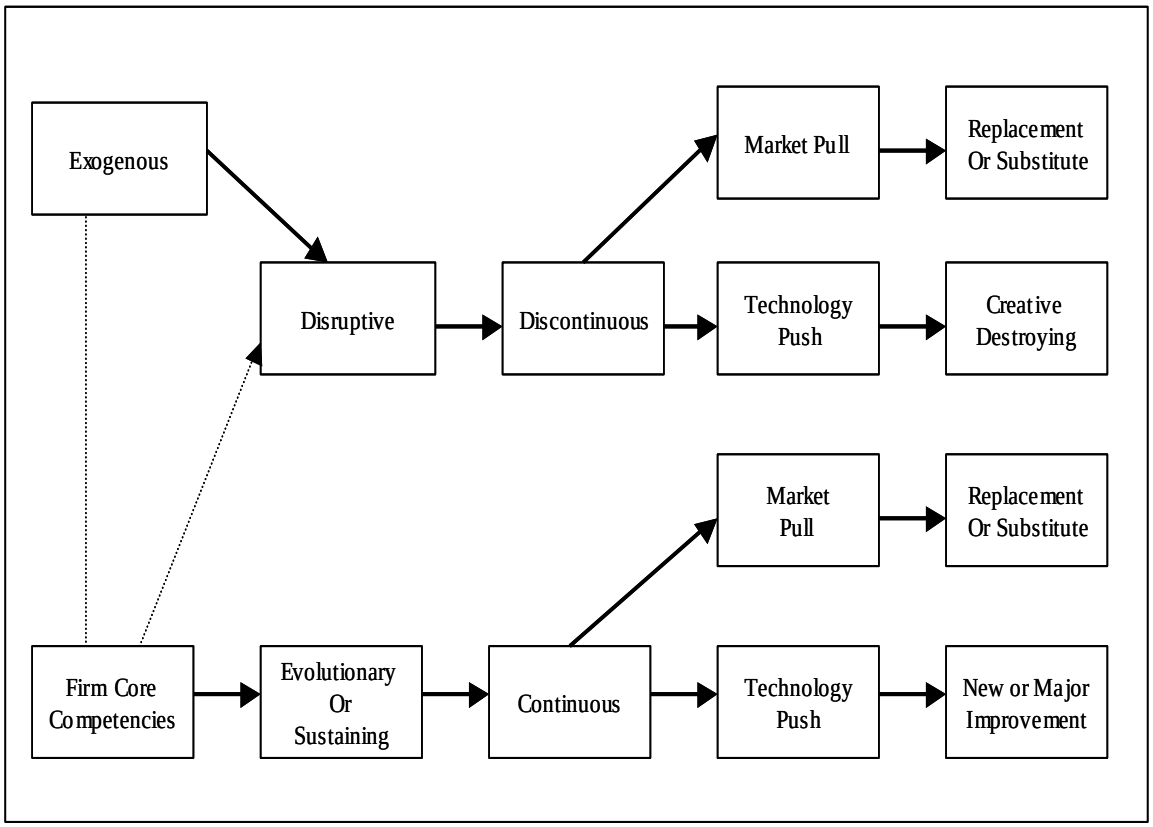

Figure 1: Model describing disruptive and sustaining technology (Walsh & Kirchhoff, 2000:323)

The model graphically shows the difference between disruptive technology and sustaining technology (Walsh & Kirchhoff, 2000:323).

Disruptive technology has the characteristic to potentially discontinue technologies currently used in a firm. The original idea or concept leading to disruptive technology may either rise from the information technology used for the core competencies within a firm or from exogenous input. If the market realises the potential of disruptive technology, the market may pull a product on the market with the effect of simply replacing or providing a substitute for current in-use technology. The difference between disruptive technology and sustaining technology is that disruptive technology can have result in destroying or replacing sustaining technology. Sustaining technology, on the other hand, will be enhanced with a version upgrade as a result of new or major improvement of the system functionalities.

Characteristically, evolutionary or sustaining technology has the characteristic to continue as the current in-use technology used by the firm. If sustaining technology pushes a product into the market it is basically the existing technology with new features that will provide a new and major improvement based on the request by the users or the firm.

From the model it can be derived that disruptive technology differs from sustaining technology in the sense that disruptive technology is a new creative technology, which replaces or has the effect of discontinuing current technology and making the current technology redundant, therefore, destroying the current technology. Sustaining technology entails development of current technologies but on a continuous basis. The result of innovation in terms of sustaining technologies is that the current technologies are enhanced of upgraded with new or major improvements.

Walsh and Kirchhoff (2000:324) concluded that during their research it was difficult to identify a disruptive technology prior to implementation and prior to the use by different users. It is often difficult to predict what effect disruptive technology will have on the industry and which industry the disruptive technology will enter. Characteristics of disruptive technology should give insight on how to predict if a new technology will become a disruptive technology.

2.4 Characteristics of disruptive technologies

It is difficult to identify disruptive technology in advance because of its strange characteristics. Disruptive technologies are usually only identified after their effects are known and the benefit is seen with hindsight (Jones, 2005:19). Walsh and Kirchhoff (2000:323) emphasised that disruptive technologies have to mature over a period of time to evolve from an innovation to a useable product.

Christensen and Bower (1995:10) refers to disruptive technologies as innovations, however not all innovations are disruptive. To understand the characteristics of disruptive technologies it could be appropriate to look at the different types of innovation as presented by Rayport and Jaworski (2004: 81):

- Innovation as a user-driven enhancement - The purpose of technology development that is user-driven enhancement tries to add low-cost, value added technology to sustaining technology that implies low risk.

- Innovation as a developer-driven development – Developers of technology has identified a limitation in current technology and has developed a new solution. This means that user needs have been identified and a new solution is developed that will provide the technology according to the user's needs.

- Innovation as a user-based context development – Market research has identified a limitation in capabilities of technology. New technology is developed to make provision for the needs of the user and therefore the context of the user determined the development of the new technology.

- Innovation as a new application or combination of technologies – The potential of technology developed for a specific industry is applied to another industry.

- Innovation as technology/market co-evolution – These innovations creates new industries by developing great solutions but the markets have not been established yet.

From the above it can be derived that it is only when an innovation addresses a new industry or an emerging market that the particular innovation becomes a disruptive technology. To clarify the difference between innovations and disruptive technologies the following characteristics (Christensen, 2000:xviii) can be listed:

- The disruptive technologies are cheaper when procuring and implementing the product;

- The disruptive technologies are simpler to ensure that the consumer will be able to use the technology without intensive training;

- The disruptive technologies are smaller than expected which indicates the advancement of the technology;

- The disruptive technologies are more convenient to use to limit the effort when using the technology;

- Disruptive technology usually does not propose greater profits, but it would add value to lower margins.

- Disruptive technology is also described as technology, which has a characteristic of “radical change”. Radical change technology implies technology, which requires very different technological capabilities. However it is when a new technology is implemented and the technological change destroys the value of competencies, the new technology has a negative impact on the company. If the new technology enhances the value of competencies, the implementation of the new technology will be successful. Disruptive technologies have the characteristic that influence long-held business rules allowing organisations to break free and apply radical business changes.

- Another aspect of disruptive technologies are that they can originate “from outside the industry that they affect”, also known as an exogenous effect (Walsh & Kirchhoff, 2000:321). This characteristic indicates the unexpectedness of disruptive technologies and the inability to predict how and where the technology will be used. It is difficult for potential customers to know that a need exist for the utilisation of a disruptive technology (Jones & Smith, 2005:19).

- The unpredictable characteristic of disruptive technology is also defined as “scientific discoveries that break through the usual product/technology capabilities and provide a basis for a new competitive paradigm that influence the behaviors and benefits for customers” (Kassicieh *et al.*, 2002a:340).

- Risks are always involved when implementing disruptive technology because of the nature of unpredictability. Large firms, that are aggressive, innovative and customer-sensitive, usually follow the sustaining technology approach. The importance of supporting the customer is of greater importance to these large firms than innovative disruptive technology that could be a risk to the firm.

- It is difficult to predict the value of a disruptive technology. If disruptive technology does not promise to increase profits, large firms will not invest in such technology as they focus on profitability and growth. From the literature it can be derived that disruptive technology is most often launched in emerging markets and smaller companies where the risk of profit loss is smaller.

To understand the characteristics of disruptive technology it may be appropriate to examine technologies that have been displaced by disruptive technologies in the following section.

2.5 Disruptive technologies in the information technology environment

Disruptive technologies have the tendency to unexpectedly provide different functionality resulting in the displacement of current technologies or sustaining technologies which are part of the mainstream system architecture used in the organisation.

The following table presents disruptive technologies that have replaced sustaining technologies:

Disruptive Technology	**Displaced Technology**
Internet Protocol Suite	Networks that are proprietary or fixed-configurations
Minicomputers	Mainframe computers

Personal Computers	Minicomputers
Flash drives	Floppy disk drives
Wi-Fi (Wireless Networking)	Standard Network Infrastructures

Table 1: Information technologies displaced by disruptive technologies

Disruptive technology can provide functionality that is new and not available in the market. The following table presents innovative technologies that, while not necessarily displacing other technologies, provide functionality that have the potential of disrupting the technology currently used by businesses (Patki, 2006:18).

Disruptive Technology	**Description**
VoIP	Voice over Internet Protocol
Bluetooth	Provides a universal short-range wireless capability (Stallings, 2005:310)
WiMAX	Worldwide interoperability for microwave access

Table 2: Disruptive technologies with possible disruptive functionality

The Internet is also an example of disruptive technology that changed the way business was done through the e-commerce approach. By applying Internet capabilities to business, the rapid development of many and varied innovative technologies have been established.

Evans (2003:19) describes the following as disruptive technologies in the information technology arena:

- Web Services – These services enable businesses to provide services such as applications, information and tasks to be available on the network. Web services provide opportunities to businesses to enter new markets, provide

more opportunities for business growth and improve the competitive advantage of a business.

- Peer Services - Peer-to-Peer (P2P) is described as “Any application or processes that uses a distributed architecture and allows direct bidirectional communication between resources” (Tsui, 2001:16). P2P provides functionality, which enables the manageability of knowledge, consistency of information and system security.

- Real-Time Computing – All transactions made on the system of a business are available in real-time, which imply that business reports can be produced within a very short period, even within minutes or seconds. The opportunity of business benefit of this disruptive technology is applicable to operating systems, middleware, applications and business processes.

- Business Process Management – Information technology enables business to create and manage the business processes themselves and provide a holistic view on all business processes of the various business units to ensure efficient interactions between various entities, such as applications and people.

- Mobile Business – These services include the following: mobile commerce, electronic tagging, wireless infrastructure management, telematics, and location-based services (Evans, 2003:123).

Disruptive technologies often provide new technologies that can be applied to the benefit of the business. These positive aspects and qualities of disruptive technologies can be used to the advantage of a firm, but the firm should also take cognisance of the disadvantages of disruptive technologies.

2.6 Advantages and disadvantages of disruptive technologies

After assessing the advantages and disadvantages of disruptive technologies, the potential value of using disruptive technology will become clear.

2.6.1 Advantages of disruptive technologies

The following advantages of disruptive technologies have been identified:

- Disruptive technologies provide an alternative to sustaining technologies. Innovators who are creating new ideas have to rely on sustaining technologies to manufacture or produce their products. Disruptive technology provides new capabilities in a shorter development period that support the innovator's ideas. Embedded technologies may allow the use of disruptive technology, improving the response time of the system that ensures reliability and provides determinism (Kulkarni, 2006:32).

- Although disruptive technologies do not focus on profitability, it can provide immediate profitability when used in the relevant environment (Walsh & Kirchhoff, 2000:319). The literature indicates that small firms play a significant role in the commercialisation of disruptive technology. When small firms acquire disruptive technology the aim is usually to support creative innovation, which will secure profitability for fast financial growth for the business (Kassicieh *et al.*, 2001:667).

- Disruptive technology enables businesses to implement technology on reduced costs. Patki (2006:18) provides a scenario where WiMAX was implemented on the island of Mauritius. By using WiMAX rather than broadband, the costs have been reduced and this has made technology affordable for private as well as business users on the island.

- Disruptive technology allows the user quick entry into the market place. For small firms that are willing to take the risk, disruptive technologies promise opportunities for early and strong entry into existing and new markets (Walsh & Kirchhoff, 2000:319).

- Disruptive technologies provide a growth opportunity to companies that recognise the opportunities offered (McGinn, 2001:13). VoIP is a service provided by information technology, and communication companies such as

Time Warner and Comcast in America are scrambling to provide VoIP services as part of their offerings to their consumers (Sevastopulo & Taylor, 2004:15). VoIP is considered a disruptive technology in the information technology arena, and is cheaper than current communication service providers: this influences the use of fixed line telecoms as well as the mobile telecoms (Sevastopulo & Taylor, 2004:15).

2.6.2 Disadvantages of disruptive technologies

The following disadvantages of disruptive technologies have been identified:

- Disruptive technologies do not support current firm based manufacturing practice or mainstream software (Walsh & Kirchhoff, 2000:319). Current production processes have to adopt new technology or discontinue production, which could have a delay in production and ultimately influence profitability.

- The use of new technology always implies inherent risks. Customers may resist new technology and therefore the business using the technology could experience failure (Walsh & Kirchhoff, 2000:319). Failure implies costly endeavours that do not deliver payoffs to investors.

- Disruptive technology demands a new way of marketing a product. This could lead to additional problems. Firstly, the marketing managers could resist marketing the new product because of their uncertainty regarding the estimation of the value of the new product or new technology. Secondly, business could also experience internal problems because of the resistance of the user to use the new technology and change management might be required to change the user's behaviour to incorporate the new technology (Walsh & Kirchhoff, 2000:319). Strong leadership is required to encourage the social system of the business to adopt new technology (Patki, 2006:18).

- Disruptive technology also raises financial concerns. It is hard to quantify the commercialisation of disruptive technologies and therefore difficult to plan for financial investment (Walsh & Kirchhoff, 2000:319).

- It is difficult to commercialise disruptive technologies or to exploit the product for profit, especially when it is difficult to estimate the value of the product or the quality of the product (Dowd & Walsh, 1998:442). New technologies could be more complex and factors, such as the value and the application, could be difficult to determine.

- Disruptive technology constitutes a threat to most companies, as the opportunities and growth possibilities are not recognised by the CIO (McGinn, 2001:14).

Evaluating the advantages and disadvantages of disruptive technologies should provide guidelines when considering implementing disruptive technology or not. This insight gained could support the decision whether or not to implement disruptive technology that will be beneficial to the value network of a company.

2.7 Technologies in a value network

A firm's success can be measured in terms of the firm's value network within the business environment. The value network is defined by Christensen (2000:36) as "a firm's interaction with entities such as customer needs, how problems are solved, how inputs are procured to strive for profitability and how it reacts to competitors". A value network may be described as a nested commercial system. The different business units within a firm contribute to the success of the firm, which is to be profitable which will ensure the growth of the firm. The information technology system architecture supports the different business units within the firm. The system architecture, which consists of various technologies and components such as hardware and software applications, forms the information technology value network.

Value networks have a profound influence on a firm when facing new technologies. Sustaining technologies supports the mainstream system architecture to ensure the continuation and growth of a firm. Sustaining technologies are upgraded to support the value network of a firm on a continuing basis to provide a stable IT environment. It could be difficult for disruptive technologies to get a foothold in such an environment, which may impose a risk to the value network. When management considers implementing new technology, cognisance of the value network will be taken into account when evaluating the impact of the new technology on the value network. It is the perception of most managers that a new technology has to be able to interact with the mainstream system architecture in order to continuously support the business. However, management's recognition of the potential value of disruptive technology and the effectiveness of the technology application will influence the success of the business (Dhar & Sundararajan, 2007:126).

Sustaining technologies, which support the mainstream system architecture, can be perceived as organisational impediments when considering implementing disruptive technologies. Management may prefer upgrades for sustaining technologies that are familiar to the users or clients, which are easy to use and address the needs of current customers of a firm. Furthermore sustaining technologies, which are successful in the value network, receive effort levels and expenses from management in terms of research, development, sales, marketing and administration.

It is clear that entrant firms or smaller firms have an advantage when implementing disruptive technologies (Christensen, 2000:62). A differentiation is made between "established firms" and "entrant firms". Established firms are firms that use sustaining technology and are using the prior technology. Entrant firms are firms that are entering the industry during the event of technology change (Christensen, 2000:9).

Extensive system architecture usually does not exist at smaller or entrant firms; therefore a value network has not yet been established. Thus, introduction of disruptive technologies into the value network will be easier for a smaller firm. On the other hand, larger established firms will take cognisance of the known value network to determine if new technologies will be beneficial to the firm before taking the risk to implement new technologies. Established firms would rather change their strategies or cost structures to support sustaining technologies that will lessen the possibility of loss of clients, while entrant firms tend to implement strategies and cost structures to support the implementation of disruptive technologies.

2.8 S-Curve Framework for disruptive technologies

The success of a firm can be measured in terms of the value network within the business environment. The impact of the value network has to be taken into consideration when strategic planning for information technology takes place, as the value network has a direct influence on the performance of the company. Strategic planning uses the S-Curve framework to make projections of the performance of the company. The S-Curve concept is also used to indicate the performance improvement of a product within a given period (Christensen, 2000:44). If a possibility exists that an established technology could be supplanted by a new technology, the S-Curve framework is often used to predict the outcome.

Managers in the digital economy environment face a monstrous wave of disruption of technologies, which will radically shift power and create wealth in virtually every sector of business. The S-Curve production line provides a measure to manage product performance. A continuous S-Curve indicates a product line that follows a general product lifecycle. Products usually reach a maturity stage during which it becomes very difficult to improve the product. During this stage the product lifecycle reaches a point of inflection, also referred to as the fault line.

It is at this point that when a disruptive technology can overtake the established technology. When an S-Curve is intersected by another it indicates that the organisation has jumped from one technology (used over a period of time) to another technology, indicating the adoption of a new technology. Thus, a new technology has disrupted the product lifecycle of the existing technology.

Moore (2000:13) discusses the concept of the fault line presented in the S-Curve in the business model of a production development. The following illustration presents the S-Curve of a business model of a product. The second S-Curve illustrates how the disruptive technology will overtake the projected success of the first product.

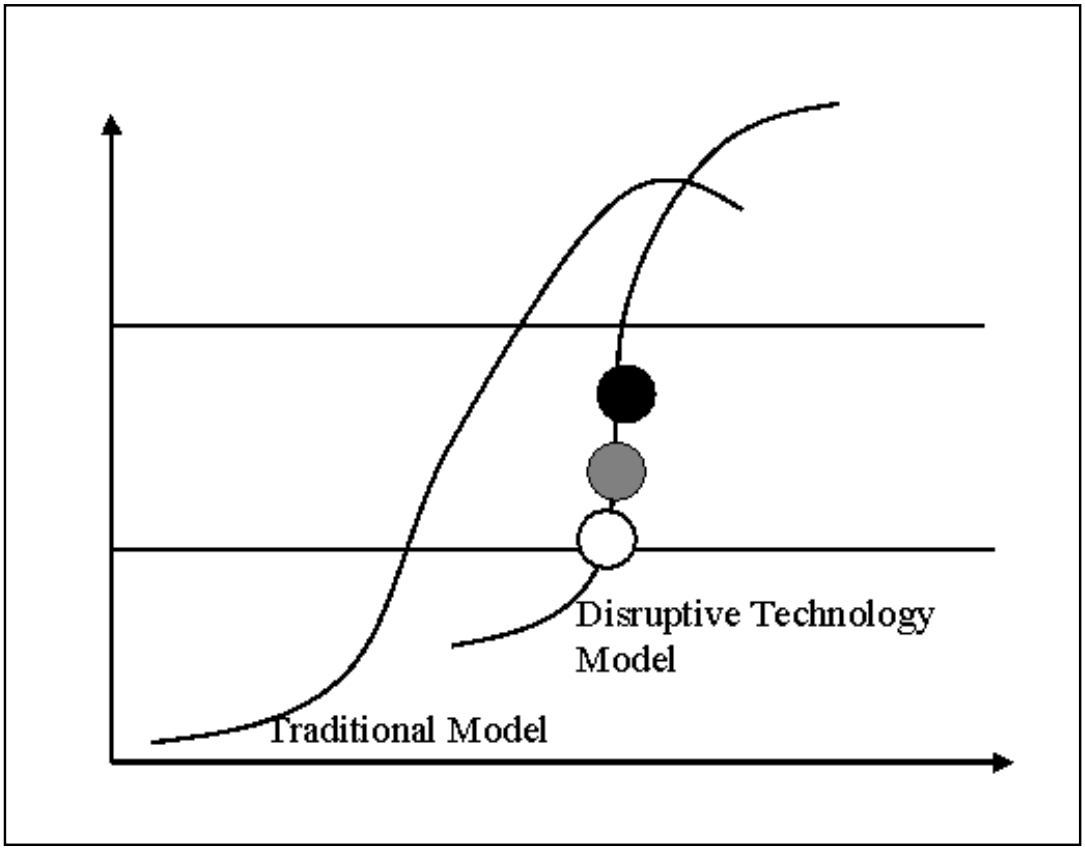

Figure 2: Disruptive technology model (Moore, 2000:13)

The disruptive technology S-Curve Framework indicates the possible point of inflection. The point of inflection is usually the point where a new technology will succeed the previous technology. Usually it is difficult for companies to anticipate

when a new technology is threatening an existing technology or when a new technology becomes the successor technology. The problem which companies face is to know when to switch to new technology to keep a competitive advantage in the business arena. Christensen (2000:58) indicates that the S-Curve framework is a good indicator when managing sustaining technologies. However historical data is not available to indicate the movement of disruptive technology on the S-Curve. This means that the IT business unit has to observe the movement of the disruptive technology as it moves along the S-Curve of the sustaining technology. The IT business unit must be prepared and able to react when the point of inflection occurs.

Disruptive technology often penetrates the market unexpectedly, as can be presented in the figure below, which indicates the performance of the disruptive technology over a period of time (Disruptive_technology, 2007).

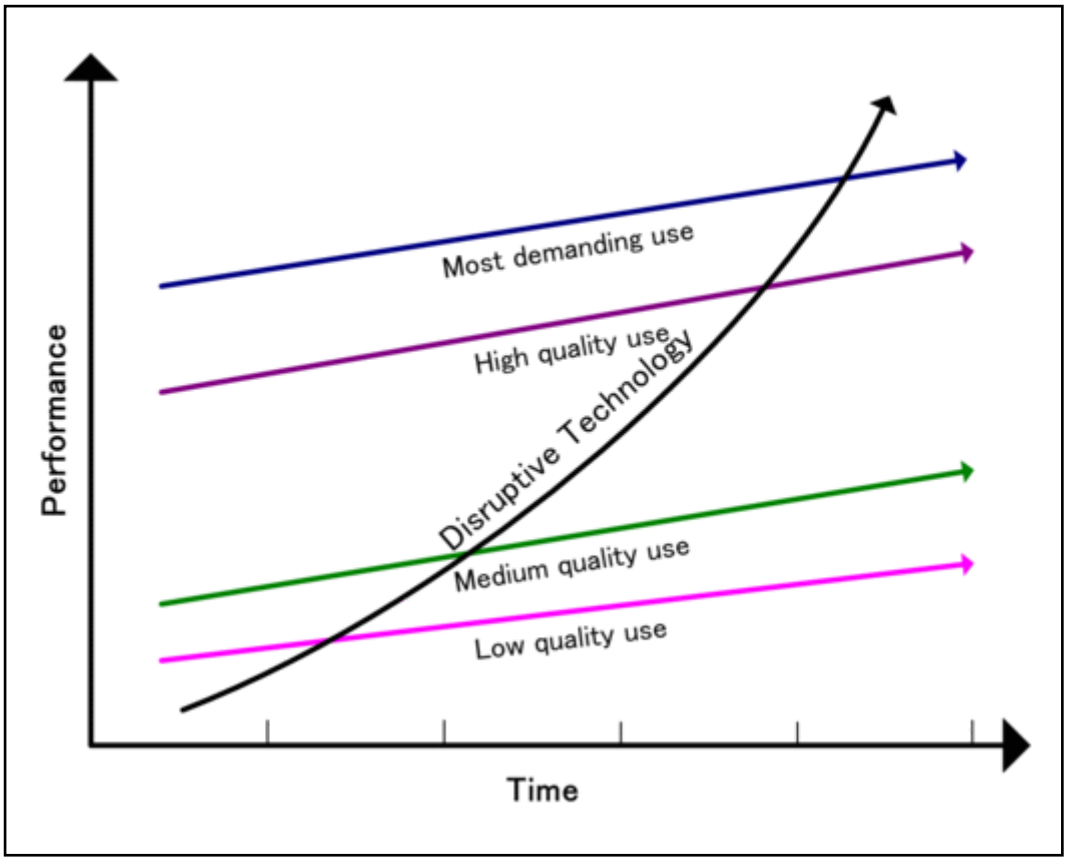

Figure 3: Performance of disruptive technology over time (Christensen, 2000:23)

The performance of disruptive technology over a period of time as presented in figure 3 shows disruptive technology as it enters the low-end of the market sector where the full potential of the technology is underestimated. When the lower end of the market adopts the disruptive technology, the disruptive technology is improved to make it more attractive to be adopted by high-end of the market. The high-end of the market expects functionality of higher quality that will exceed current technology in the market sector. The functionality of the disruptive technology is improved to satisfy the needs and requirements of the customers who are willing to pay for a better product. It is when disruptive technology provides a better solution than sustaining technology and customers realise the potential of the disruptive technology, sustaining technology will be replaced (Christensen, 2000:33).

Other factors also influence the decision to implement a new technology; these include business and information technology trends. This will be discussed when the impact of disruptive technologies on organisations are investigated.

2.9 Impact of disruptive technologies on organisations

Disruptive technologies are technologies that influence the digital economical environment unexpectedly and without prior knowledge. Usually it is difficult to know which technology will disrupt the digital economy environment. Therefore it is important to know how to identify a disruptive technology, how to apply it in a specific digital economy environment and control the influence of the disruptive technology in an organisation.

Disruptive technologies can have an impact on any organisation. A business may be satisfied with the sustaining technology, and is not aware of disruptive technology that could be a threat to the information systems. If a business does not respond in time to the disruptive technology, the business could lose its competitive edge or the business could be vulnerable to threats. Businesses should always be aware of change to ensure that the leadership, vision, strategic focus, valued competencies, structures, policies, rewards, and corporate culture that were all so critical in building the company's growth keep the competitive advantage.

It has been shown that companies tend to fail when facing new technology. Studies undertaken focused on subjects, such as managerial problems, organisational and cultural changes of the organisation. Failure implies costly endeavours that may not necessarily deliver payoffs to investors (Walsh & Kirchhoff, 2000:319).

Christensen (2000:xx) reports that for a firm to perform better than other firms, a correlation between the capabilities of the firm and the percentage of implementing technological change must exist. If a firm cannot solve technological problems, it will not venture to implement disruptive technologies. When the value of competencies is negatively impacted by new technology, the

firm will fail. It is only when new technologies support or enhance the value of competencies that a firm will be successful (Christensen, 2000:31).

The market is familiar to technology currently in use. Innovation for sustaining technologies is based on enhancing the information technology currently in use by a business in terms of its products, processes or services with the purpose to increase its profitability and/or market share. Innovations for sustaining technologies are less risky for a firm. Disruptive technologies however have the "nature of uncertainty, because the use of the technology has not yet been established, the processes or services that the technology could be applied to are not tested and/or the reaction of the market is unknown" (Kassicieh *et al.*, 2002b:342).

Well-established firms have the capability to perform marketing research and conduct good planning before taking the risk of procuring disruptive technology. However, if disruptive technology is not in use or applied, then markets do not exist. Therefore, market research is not viable and marketing data is not available for analyses. Firms will be taking a risk by procuring disruptive technology and without market research data. Timing of when to enter the market with a disruptive technology is important for business success (Cooper & Smith, 1992:60). Nault and Vandenbosch indicate that the disruptive technology with the most market response will be more successful and more profitable (2000:1).

Established firms do not easily commit to implement disruptive technologies either because of lack of vision, or unskilled resources, or even a lack of information of the technology (Cooper & Smith, 1992:60). Added to this, it seems as if sustaining technology does not provide a competitive advantage, because technology followers are on the same level as technology leaders. Only the first-mover with disruptive technology will have the advantage and get the competitive lead in the business industry.

Christensen (2000, xii) states that well-managed firms should deliver new technologies with functionality that is better than the customers requested. A

successful firm will strive to provide the best solution at the right time to satisfy the needs of the customer. He also indicated that companies who do not invest in disruptive technology could not claim to base their decisions on principles of good management. The progress of new technologies has the potential of being more advanced than what the market requires. If management does not realise the potential of the innovative technology, the chances are that the competitive edge could be lost.

Management however has “trouble capitalizing on the potential efficiencies, cost-savings, or new marketing opportunities created by low-margin disruptive technologies” (Evans, 2003:11). Critical issues in terms of disruptive technologies include the impact on a business in terms of the following (Evans, 2003:11):

- IT governance is questioning the real improvement of productivity and performance since information technology has been implemented in organisations. For an example, Internet technologies have been available since the 1970’s, but were only been fully adopted by some organisations during the last few years of the 1990’s. The evaluation and investigation of disruptive technologies is important to ensure that services are improved and productivity is increased and that revenues are increased. Disruptive technology must support the IT governance and business strategy of the organisation.

- Security of the information network of a business is a growing concern. The possibilities and functionalities of new technologies require businesses to ensure the safety of their information, their people, the physical assets and information systems. The Internet applications require businesses to open their network to enable customers, partners and suppliers to make transactions directly. This causes businesses to safeguard their information networks in terms of access control and encryption techniques.

- In order to ensure security to business partners, business will approach new technologies with caution. If business is disrupted the effect can influence

the stock price, which in turn may influence the reputation of the business amongst the customers and suppliers.

- Within the information technology environment standards and protocols have been developed to ensure quality and standards of information technology hardware and software and also to establish a platform or foundation, which enables networks between businesses and other entities. Disruptive technologies could have an impact on these standards. With disruptive technology a firm should be able to accommodate the technology by adjusting the IT standards.

- Economic uncertainty in business emphasises the control on costs and return on investments in information technology. Information technology departments have to justify costs and explain the value of information technology hardware and software in terms of the purpose and utility thereof. Established firms have to make difficult decisions on the level of investment in correlation to the magnitude of commitment to be made (Cooper & Smith, 1992:61). Serious investments are usually made by established firms after marketing data about the disruptive technology has become available or the potential of the disruptive technology has been established.

- Disruptive technology can have an impact on any area in terms of information networks, e.g. security, copyright, etc.

- Business must realise that to invest into disruptive technology is a high-risk endeavour. The proposition of high rewards is one of the advantages of disruptive technologies, but the increasing level of risk should be taken into consideration.

- Disruptive technology also influences the organisation in the production line. Organisations must establish an awareness of the potential of disruptive technology that can penetrate the information technology market influencing

of their current combination of products and services, which can have an influence on the financial success of the business. This product will have the appropriate characteristics, production infrastructure, process methods and buyer needs that are identified and satisfied by the innovation.

- Disruptive technologies can have an influence on operational procedures of a business and therefore it should be required that the policies and procedures of an organisation are in place to control the impact.

A scenario can illustrate how disruptive technologies may impact an organisation. For example an organisation can have a service legal agreement with a specific vendor. A disruptive technology that will be more beneficial to the organization may become available in the market. This organisation then has to make a decision whether to incorporate the new technology and terminate the services of the first vendor or to integrate the new technology with the current technology solution.

2.10 Guidelines and principles for managing disruptive technologies

As discussed above, emerging or disruptive technologies can have an impact on businesses; therefore business should follow an approach, or manage a business strategy, to handle emerging or disruptive technology. Established firms tend to follow traditional strategic approaches when contemplating disruptive technologies, however management should ensure that the strategic approach is flexible to allow for experimental strategies that will minimize the impact of implementation of disruptive technologies (Cooper & Smith, 1992:69).

Business has realised that when a disruptive technology is beneficial to the firm, it is important to estimate the business value of the emerging technology. Added to this, business should also be able to determine if any emerging technologies contain threats to the information system architecture, the information of the firm and the competitive advantage of the business.

The following information provides detail on how a business should be prepared to handle emerging technologies or disruptive technologies:

2.10.1 Involve executives and management

The IT business unit should ensure the involvement and buy-in from the executives of the firm to understand the possible impact of emerging or disruptive technologies on the firm. Executives should understand the importance of early detection of disruptive technology and understand the characteristics of these technologies to establish any value for competitive advantage, to identify technologies that could be an opportunity to reduce costs or to improve productivity. Therefore management should support the effort the IT business unit has to put in or the strategy the IT business unit has to follow to detect emerging or disruptive technologies.

Generally speaking, the involvement of a firm's management has changed over the years. Earlier, information technology was used primarily for specific purposes and departments within the company. The firm's purpose was to financially support the project. As information technology has entered and been utilised throughout the firm, management realised that active engagement with the project is required. Therefore firms had to change the concept of overall IT management.

As the management of information technology became more involved and complex, the firm has to change the approach towards IT project management. As firms took over the responsibility of the control of hardware, software and IT staff from companies providing these services, IT project management became the responsibility of the individual firm.

The IT department in a firm usually oversaw the IT project management on behalf of the various business units within the firm. However, as the environment changes, firms realised that a tight integration between business and technical activities is required to ensure that the information technology application support the business needs of the various units. Therefore the composition of the project

management team has changed to include information technology staff as well as staff from the business units (Dickson & De Sanctis, 2001:20).

2.10.2 Define business process

The IT business unit should define a business process, which indicates the different phases of how the firm should manage this strategy when disruptive technology is approached. The business process should include different phases from detection of a disruptive technology until the technology is evaluated, implemented and tested by the firm. During the detection phase it is important to consult advisors, customers, business partners, media, academics, consultants and analysts. The business process must manage the evaluation process of the disruptive technology but also ensures that the effort of evaluation is not duplicated or over-estimated.

The business process for disruptive technologies can include several activities as presented by Veryzer (1998:313). According to him, the business process begins with the “Dynamic Drifting Phase” during which the disruptive technology is explored. This is followed by the “Convergence Phase”, characterised by a person who acknowledges the potential of the technology, motivates the functionality and persuade the organisation to consider the technology. During the “Formulation Phase”, requirements and expectations of the technology are formulated. Then, the “Preliminary Design Phase” and “Evaluation Preparation Phase” follow. The technology is developed during the “Formative Prototype Phase”, which is followed by the “Testing and Design Modification Phases”. The last phase includes the “Commercialisation Phase” during which the product is ready for marketing (Veryzer, 1998:316).

2.10.3 Prioritising disruptive technologies

Business objectives should be used to determine and prioritise which emerging or disruptive technologies will be selected for evaluation. Disruptive technologies can be prioritised based on various aspects such as maturity level of the technology in the market, unreliable vendor products, or outcome of

implementation is too uncertain. Disruptive technologies that are identified as important can be used as a proof-of-concept. Promising disruptive technologies that show business value benefit can be researched and experimented with on a small scale before it is applied to all the business units of the firm.

2.10.4 Integrate disruptive technologies and current initiatives

Disruptive technologies that possess the potential of business value can possibly be embedded or integrated in current in-use technologies to extract more value from existing sustaining technologies. The IT business unit can use disruptive technology to enhance existing solutions and upgrade the information system architecture. When a disruptive technology is introduced to an organisation, most established firms will follow an approach to establish a close collaboration between organisational units, rather than total separate units. Highly skilled and experienced resources ensure that the implementation of disruptive technology happens within the administrative sections (Cooper & Smith, 1992:68).

2.10.5 Combine disruptive technologies or emerging technologies

Emerging or disruptive technologies can be combined to provide a solution that is beneficial to the business. However it is a challenge for the IT business unit to recognise the potential of emerging technologies and how a combination of these technologies can be utilised that could fit in the value network of the business.

2.10.6 Monitor on a continuous basis developments in the information technology arena

In order to be able to detect a disruptive technology that could be of business value, it is important that the IT business unit should continuously be alert to emerging technologies. The IT business unit should also be aware of the requirements and business needs of the different business units within the firm, to know if new technologies could be applied to the business. It is expected that IT project management anticipates the changes that can have an impact on current systems used within the firm. This is difficult to anticipate, however, an important IT project management responsibility includes focusing on change within the different business units and the firm’s relationship to other role players

within the business arena, such as changes in customer needs, other business partners and the industry (Dickson & De Sanctis, 2001:23) to determine the information technology required.

2.10.7 Test if a disruptive technology will be usable in the organisation

The IT business unit can identify in-use existing user applications that are used in the mainstream technologies that do not actually satisfy the user needs. Using this information the IT business unit has to research emerging technology and then identify a disruptive technology that could replace and/or substitute existing user applications.

2.10.8 Creative thinking

Management should encourage entrepreneurial development throughout all levels in the company to be creative and develop new ideas. Creative thinking enables people to recognise the potential of disruptive technology and how it can be applied to the business (Patki, 2006:18).

2.10.9 Manage disruptive technologies as a risk

The basic principles of risk management can be applied to manage innovative technologies. Vedpuriswar, *et al.* (1999:113) have described the basic principles of risk management that can be used to provide guidelines to companies to manage innovative technologies. In some instances not taking a risk with disruptive technology could be the risk the firm cannot afford not to take.

Fundamental questions, such as the following, may assist an organisation to make an informed decision:

- What are the various risks the company is facing?
- What is the magnitude of each of these risks?
- How can the risks be managed to be beneficial to the wealth of shareholders?

2.10.10 Manage the resources to research the impact of disruptive technology

Bringing in a new technology in the organisation may divert resources from its existing business. Resources include employees, money, hardware and applicable software. Large firms often “neglect discontinuous innovations and resources are applied to incremental change or continuous improvement” (Kassicieh *et al.* 2002a:340) despite the fact that incremental innovation has not been shown to be a designated path for sustained competitive advantage.

2.10.11 Marketing disruptive technology

The IT business unit has the task to market a new technology within the firm during the total project lifecycle of a new technology. This implies that the IT business unit can introduce a change management programme, which will provide information of the new technology to the business. As previously indicted, it is difficult to envisage the viability and value of disruptive technology. Marketing data for the new technology is usually not available and therefore it is difficult to motivate the implementation of a new technology. It is generally accepted that it is easier to sell replacement or substitute technologies as with these products, customer behaviour does not have to change radically. The customer is familiar with previous versions of the product and therefore will support the sales aspect in terms of costs and performance advantages (Walsh & Kirchhoff, 2000:323). Usually, management will base a decision of implementing a new technology on the data of marketing research. If the marketing research indicates that the feasibility of the new technology will not be rolled-out successfully because of lack of interest by other firms, management may shelve the proposal to implement a new technology.

The value of disruptive technology cannot be known in advance and marketing data is usually not available when disruptive technology becomes available in the market. Management will therefore have to make assumptions regarding how disruptive technology will be accepted by the users. To keep risks to the minimum, managers can test their initial assumptions against other similar situations. Although the data will not be accurate and fully applicable to the new

technology, some data will be available that may be used to make predictions (McGrath & MacMillan, 1995:53).

2.10.12 Use the information gathered during the commercialisation of the disruptive technology

Kassicieh *et al.* (2002b:375) introduced various methods to be used to commercialise both disruptive technology and sustaining technology. The methods are based on certain tests that are based on differences in activities and decision-making processes influenced by the different technologies. Information technology companies use these activities and factors when they commercialise a disruptive technology. These activities and factors can be used by business when evaluating disruptive technology to make a strategic decision on procuring disruptive technologies. Kassicieh *et al.* (2001:342) defined factors that will influence the commercialisation of disruptive technologies, namely:

- The nature of the technology: sustaining or disruptive
- The size of the company: small firm or large firm
- The source of the technology: internal or external to the firm
- The strategic intent of the firms

Small firms reap the benefits of disruptive technologies that are the driving force behind the commercialisation of disruptive technologies.

2.10.13 Maintain strategic flexibility

A company should be able to incorporate disruptive technologies when it enters the emerging market. Strategic commitment is required to implement the new technology to ensure that entering the emerging market will be successful. Disruptive technology will effectuate changes to the current business model of a firm. Old business concepts have to be transferred into new business models to incorporate the new technology. Disruptive technology influences the way business is done, the way people are working. Disruptive technology changes the way a firm creates, produces and distributes products and services. Therefore a

new business model must make provision to incorporate all aspects of the new technology (Dickson & De Sanctis, 2001:57).

Forces that influence decision making in firms have an impact on the technology to be used, that is technology that forms part of the value network. These forces include powerfull companies ensuring investment in the firm. Strategically, it makes sense that management will choose to implement technology that will support the needs of their most influential clients. Clients will be retained and the firm will be sure of income and growth.

Another important strategy is to use sustaining technology to support the clients of the organisation. Sustaining technology supports a company by providing performance improvement.

The implementation of disruptive technology is dependent on the strategic planning proposed by the management of a firm. Implementing disruptive technology creates inevitable unpredictability and uncertainty. When implementing a disruptive technology management should make provision in the business model for unknown events that may occur.

When the new technology is implemented and used, analysis can be performed to establish more accurate data to be used optimally in strategic planning. The firm's business plan should be flexible enough to incorporate assumptions and data when it becomes available, when a firm learns from experiences during the initial trial and error phase (McGrath & MacMillan, 1995:44).

2.10.14 Humanistic approach to communication

The humanistic approach to communication implies that the potential business unit should always be considered as a factor when technology is considered. The humanistic approach includes issues such as credibility, trust, emotion and image. When introducing and incorporating new technology to a firm, management must consider the impact of the implementation on communication between the technology and the people using the technology (Dickson & De

Sanctis, 2001:149). The psychological distance between the technology and the user can be reduced by applying the following:

- the user has to be trained to use the new technology
- implementing user-friendly systems that will reduce the distance between the technology and the user
- communication between the sender and the receiver should be as streamlined as possible by the information technology.

2.10.15 Knowledge Management

Information technology enables businesses to communicate on a global scale, but this may involve teams working in different locations which will inevitably have a negative influence on knowledge sharing (Patki, 2006:19). Businesses should ensure that knowledge assets are managed to the advantage to the social system of the company and eventually to the advantage to the business.

2.11 Conclusion

Information technology has become an integrated part of business. It also supports the business and enables it to be profitable and to keep a competitive advantage. To increase competitive advantage, business leaders are continuously watching for new information technology developments that could enable the business to be more competitive. By defining the term disruptive technology and providing information on the characteristics on this concept, the business leader will understand how and when disruptive technology can have an impact on the organisation.

The value network of a firm is important and should be taken into consideration when a disruptive technology is investigated. The understanding of the relation between the business and its value network is required to establish the impact of a disruptive technology on the business. Business realises that the importance of

disruptive technology, but other business issues have to be considered when an emerging technology is evaluated.

The use of new technology always involves some risks. Customers may resist new technology and therefore the business using the technology could be unsuccessful (Walsh & Kirchhoff, 2000:319). Firms need to be flexible and have the ability to adapt to incorporate new technology and associated changes to keep a competitive advantage in the market place. These changes will reflect in the overall management of the firm, IT project management and the establishment of a new business model. Technology implementation and organisational change go hand in hand (Dickson & De Sanctis, 2001:126).

Against the background of this available information, case studies will show how South African companies are handling new emerging technology, especially disruptive technology.

3. Discussion and application of empirical research

3.1 Introduction

The previous chapters defined the concept of disruptive technology, its advantages and disadvantages, and the characteristics of disruptive technology. The literature survey provided information on the relationship between value networks and disruptive technology, how disruptive technology can have an impact on business and possible guidelines that could be used by organisations when facing new emerging technologies. This chapter reports on the research regarding the current state of the impact of disruptive technology in organisations in the South African business sector.

The research is based on the qualitative case study research methodology executed on interviews with management from different organisations, namely organisations A, B and C.

The approach used to undertake the research will be outlined in this chapter. The research strategy and the research methodology will be discussed, including the description of the instruments used for the research. Finally, the analysis and interpretation of the interview results will be presented.

3.2 Case Study Research Methodology

3.2.1 Approach to Case Study Research

Different categories of research goals have been identified. This research paper uses the social goal as a category of research methodology. Olivier describes a social goal as those goals “that deal with the people side of computing”, for example the management of IT (Olivier, 2004:11). However the description of the philosophical goals “that deal with responsibility and implications of using computing systems” (Olivier, 2004:11) could also be used.

The research methodology is based on two methods, namely a literature survey and case study methodology.

The purpose of the literature survey was to establish the terminology and to identify the issues that are applicable to the research. The literature survey provides background to evaluate and compare scenarios in the South African business environment. The purpose of the literature survey as the secondary goal of this research is to support the case studies to be undertaken. The case study methodology will be applied to narrow the research to the South African environment.

An empirical method is used in the case studies as described by Olivier (2004:12). The case study tends to provide a qualitative empirical research rather than a quantitative research. Qualitative research indicates that the research is accurate in observations that can be used as general indicators, and may be applicable to other cases. Case studies as a research methodology has been used for business, organisational or management studies as well as other study areas such as sociology, economics, political science and psychology (Yin, 1994:1). According to Yin the case study methodology is the preferred research methodology when the researcher uses questions, which includes “why” or “how” to collect real-life context. “Questions being asked are related to contemporary set of events over which the investigator has little or no control” (Yin, 1994:9).

This research will use the explanatory case study type as described by Yin (1994:5) who defines the explanatory case study type as “An explanatory case study can be used to pose competing explanations for the same set of events and to indicate how such explanations may apply to other situations”. This study will use the explanatory research method, and test the theory, as presented in the literature survey, against the case studies.

The explanatory research method will be used as a tertiary research method, where the literature survey acts as the secondary research method and the primary research method is the case study methodology.

A major advantage of using a case study is that a vast volume of information about one or more cases can be gathered. This implies that specific cases can

be studied in more detail providing more information on a subject (Olivier, 2004:98).

A case study has the following characteristics as listed by Yin (1994:15):

- It explains the causal links in real-life interventions – which are too complex for surveys;
- It describes an intervention and the real-life context in which it occurred;
- It illustrates certain topics within an evaluation;
- It explores situations in which the intervention being evaluated has no clear, single set of outcomes.
- It may be a meta-evaluation, which implies a study of an evaluation study.

3.2.2 Case study design

The case study design follows the approach of a multiple-case design, which implies that "certain aspects of each case may be studied" (Olivier, 2004:99). The advantage of a multiple-case design is that the different case studies can be compared to provide a better understanding of the current scenarios to make it applicable for general use (Olivier, 2004:99).

Three different organisations have been approached to participate in the research and are indicated as organisations A, B and C. All the organisations are from the banking sector. A prerequisite was that the interviewees should have a broad knowledge of information technology and be on a managerial level with a number of years experience in the organisation. It was necessary for the interviewees to be able to provide information from a strategic viewpoint but also be able to provide scenarios for description purposes.

Interviews took place with managers of the different organisations. The title of the designation of Organisation A is Manager: Group Product Service Development Services in the section Corporate and Business Bank (which includes Large Business, Public Sector Business, AgriBusiness, and Professional Business

(Auditors and Lawyers). The purpose of this position is to provide innovative solutions for clients, finding solutions to get more business for the organisation to increase profitability. The interviewee is approximately a fifty year old male.

The title of the interviewee from Organisation B is the Innovative Audit Manager. This position is responsible for the quality and efficiency of information technology, which supports the business. The interviewee is approximately a forty year old male.

The interviewee at Organisation C is the Senior Network Security Officer. This interviewee is responsible for the security of the bank's network. The interviewee is approximately a fifty year old male.

Although the different interviewees have different titles for their respective designations, the interviewees have vast experience in their field and could contribute extensively to the research project.

3.2.3 Case selection

To ensure objectivity when executing case studies, it is required that case studies should be executed in a manner that can be either literally or theoretically replicated. Literal replication means that different cases that differ from the norm have to be selected. Theoretical replication means that different cases, which provide different outcomes of the research, have to be included in the research. This research project will base the case selection on the literal replication approach.

3.2.4 Case study protocol

The purpose of the case study protocol is to identify precisely what aspects will be studied. The protocol is used to provide an understanding of what precisely is expected to be learnt from the case studies and to provide information for the stated hypothesis (Olivier, 2004:99). A formal questionnaire is used as the case study protocol to establish a more controlled research methodology.

The questions derived from the literature study allowed for a more focused approach during the execution of the case studies. It was expected that questions could encourage the interviewees to provide more information than directly requested.

3.2.5 Data collection

The two main approaches to data collection methods have been defined as quantitative or qualitative (Olivier, 2004:100). This research project will use the qualitative approach when collecting data as the responses to the questions cannot be measured numerically. Issues such as security risks, impact of disruptive technology or threat of disruptive technology can only be expressed in quantitative terms.

As stated before, the advantage of a case study is that a vast volume of information can be gathered. The variety of information has the inherent possibility of supporting the theory to be tested.

According to Olivier (2004: 100), information can be obtained by different ways of data collection during case studies by:

- Studying available records relevant to the research subject;
- Interviewing relevant persons who have experience in the research subject;
- Surveying (as next option).

This research will use the information gathered during interviews with relevant experienced persons.

The maintenance of objectivity during data collection is important to the execution of a case study. The role of the observer can influence the objectivity of a case study. Therefore it is import to take cognisance of the different roles of the observer, discussed as follows (Olivier, 2004:101):

- Participant observer – The advantage of the participant observer is that the observer elicits confidence from the interviewees who may provide more information by simply responding to the questionnaire. The disadvantage of the participant observer is that the observer can have an effect on the result of the case study.

- Unobtrusive observer – The people being observed are not aware of the observer and objectivity of gathered information is ensured.

The data collection during this research project does not require that the observer has to be a participant or an unobtrusive observer. However the observer cannot be totally objective to the outcome of the research during a qualitative study. The observer who performed the interview developed the structured questionnaire and was also responsible for explaining the questions during the interviews.

The role of the observer requires that complete records of the observations have to be kept. Records will support the evidence when facts have to be verified. This research will use only one method of maintaining complete records of the observation, namely interviews will be available on tape recordings. The result of the interviews is presented as an annexure to this document.

Tape recordings have been made of all interviews. The questionnaire, which was used during the interviews, is available in annexure A of this document. The tape recordings will be kept for referral purposes. The results of the interviews have been documented and are available in annexure A of this document.

3.2.6 Data analysis and reporting

The method of data analysis and reporting has to support the selection of the cases to ensure that the cases fit the theory (Olivier, 2004:102). The pattern matching approach will be followed which includes the following aspects:

- The theory to be tested will be stated;

- From the information derived from the case study, information is collected from which relevant data can be selected or different aspects can be distinguished.

The analysis and reporting of the data is important to case studies both to ensure objectivity and to ensure that the case fits the theory, which is under scrutiny. The structure and presentation of the questions should be done in such a way that the information is collected objectively. Therefore the type of research questions used in this questionnaire was based on Yin's approach to research questions, which includes the use of the "how" or "why" questions during a case study" (Yin, 1994:7).

"The case study is preferred in examining contemporary events where the relevant behaviours cannot be manipulated. A case study can rely on two sources of evidence, namely direct observations and systematic interviewing" (Yin, 1994:8). This research approach is based on systematic interviewing.

3.3 Analysis of results

The execution of the interviews followed the order of the questionnaire, which was used to present the results of the analysis as follows:

3.3.1 Awareness of the concept "Disruptive Technologies" by the organisations

Organisation A was aware of the concept disruptive technology, but the concept had to be explained to organisations B and C. The interviewee from Organization A emphasised the difference between innovation and disruptive technologies. According to the interviewee, technologies can be innovative but are not necessarily disruptive. Disruptive can also mean that technology is used in a disruptive way influencing the way business is done.

The interviewee has the opinion that Organisation A is one of the world leaders in using information technology in the banking sector. The organisation is aware of

disruptive technology, understands why it is good for the organisation and knows that using disruptive technology will provide a competitive advantage.

The representatives of organisations B and C were not aware of the concept “disruptive technologies”, but after the researcher explained the concept, the interviewees confirmed that their respective organisations seek ways of implementing new technology to obtain a competitive advantage.

3.3.2 How organisations handle change in terms of information technology

All three interviewees from organisations A, B and C confirmed that the core business of the organization is supported by information technology. Change is inevitable and ensures growth and productivity. Therefore change in terms of technology is perceived as positive.

Organisation A recognises that disruptive technology is an important aspect for the growth and prosperity of the company. A department for innovation exists within Organisation A with the sole purpose of promoting innovation. This department provides a website where employees can submit ideas relative to how Organisation A can improve services.

Organisations A, B and C indicated that a change management process is established within their firms and this is mandatory to all information technology implementation processes. Each new technology has to be approved by a body such as Organisation B’s Change Forum. Change is inevitable but processes are in place to handle change.

Organisation C indicated that a business case is required for each new technology, which has to be followed by an investigation and pilot project. Organisation A realised that the change management process is tedious and extensive. Therefore the organisation has found ways of developing disruptive technology solutions external to the organisation for their corporate clients. These clients create flat files, which are sent to Organisation A. The flat files are used to update the system and no interfacing is required. Although not all

information technology is disruptive in its own sense, the combination and solution provided may very well be disruptive.

3.3.3 Business value of information technology within the organisation

Organisation A, B and C confirmed that core business of the organisation is dependent on information technology. The organisation cannot function without information and all data is embedded on information technology. Organisation B estimates the business value of information technology in terms of Return on Investment (ROI) and Net Present Value. If a project does not indicate business value to the business, the project will not be approved.

3.3.4 Ranking of aspects in terms of information technology

Interviewees had to rank aspects from most important aspect to least important aspect when assessing if new technology would be implemented. The result is presented in the following table:

Results of Interview relating to Question 4 of the Case Study

Table 3: Ranking of aspects in terms of information technology

Aspect *(from most important to least important)*	Organisation A	Organisation B	Organisation C
The aspects are: 1) Productivity must be improved; 2) Costs must be reduced; 3) Revenues must be increased; 4) Shareholder value can be increased; 5) Customer loyalty and satisfaction can be increased; 6) Reduce risks or pitfalls	Results from Organisation A: 4 Shareholder value to be increased is always the most important aspect to keep in mind when implementing Disruptive Technology. 5 Information technologies must be utilised to attract more customers for the business and to retain customers to ensure profitability. 2 Costs must be reduced. 6 Risks or pitfalls must be reduced to the minimum when new technology is implemented. 1 Information technology	Results from Organisation B: 5 Customer satisfactions is top priority and systems will be changed as long as the bank can retain or get new customers. 4 Profitability is important to shareholders. 6 The bank recognises the potential risks and pitfalls that can be present when implementing a new technology. 1 The information technology must ensure that the productivity of the worker will be improved. 2 To be profitable costs must	Results from Organisation C: 3 Increase in revenues 4 Shareholders value can be increased 2 Costs to be reduced 1Productivity to be improved 5 Customer loyalty - customer loyalty is dependent on good customer service and not necessarily disruptive technologies 6 Reduce risks or pitfalls

	supports all aspects of Organisation A; therefore productivity must also be improved. 3 Information technologies must support business to increase revenues.	be reduced. However technology is expensive 3 It is a requirement that each project has to increase the revenue.	

3.3.5 The relation between profitability/competitive advantage and information technology

Organisations A, B and C perceive information technology as the only way of retaining competitive advantage. Products and services provided by the organisations, under scrutiny, are very similar to those of their competitors. Therefore the only difference between an organisation and the competitors is to apply technology in such a way to keep a competitive advantage, with the resultant profitability.

Organisation C mentioned that the use of innovative technology is not always measured in terms of profitability. Disruptive technologies are also used to improve the way people work, something which does not have a direct influence on competitive advantage. For example, Wi-Fi is used to enable employees to have access to applications on the network from different campuses of the bank. Wi-Fi does not provide a competitive advantage in the sense of financial gain, but it does make working in the company easier.

3.3.6 Is new technology considered an advantage or a threat?

New technologies can be advantageous while other can be a threat. Organisation A, B and C consider innovative technology advantageous to the organisation. The executive management of Organisation B requires that the information technology department provides solutions and satisfactory services to the client. Designated employees are tasked to be aware of new technology and how it can be utilised by the organisation.

New technology is perceived as important for the growth of the organisation to keep a competitive advantage and to provide solutions that address requests from the clients. If the organization cannot provide information technology to provide a service, the organization will search for technology external to the organization, which will provide the functionality requested by the client.

New technologies such as Wi-fi and 3G can be serious security threats, which is a risk to the company. Firewalls must be in place to ensure that the information of the organization is secure.

3.3.7 Disruptive technology replacing sustaining technology

Organisation A emphasised the extensive process and change management procedures that need to be followed when a request to implement new technology is submitted. Therefore it is more likely that sustaining technology will be preferred.

Organisation B uses systems for different purposes and will use a system that is reliable and cost effective. A new technology that can replace sustaining technology will be thoroughly evaluated before it will be considered as a replacement. Furthermore, Organisation B usually will customise or modify an information system software solution to be applicable to the organisation's requirements. Therefore it is difficult to upgrade these systems because of the customisation. In this case, Organisation B will prefer using the sustaining technology. Organisation B runs a number of legacy systems that need to be replaced by new technology. Organisation B will replace older systems if the system becomes unstable, or developers become unavailable or the system cannot interface with other systems. If there is no proof that new technology will be better than the sustaining technology, the new technology will not replace the sustaining technology simply to be faster or provide quicker response-time.

At Organisation C, all proposals to implement new technology must be submitted as a business case. If the business case proves that the new technology will add value by replacing the old or current technology, the new technology will be adopted.

3.3.8 Characteristics of disruptive technology defined by the organisation

The three organisations A, B, and C use different criteria when evaluating new technology. These criteria correspond to the characteristics of disruptive technology as indicated in the literature, namely ease of use, cheaper to buy,

user friendly, shorter development time and more convenient to use. However if the disruptive technology has the characteristic of unpredictability, Organisation B will not allow the technology to become part of the information system infrastructure.

Organisation C is of the opinion that the characteristics of disruptive technology, namely “easier to use”, is not true in all cases. Organisation C has found that users who are not familiar with the new technology, e.g. 3G technology, tend to struggle when they attempt to use it.

Organisation A describes disruptive technology as technology that impacts the way business is done or on how people work. They also hold that technology can be disruptive when technologies are used in combination or are used in a different way that disrupts the market place.

3.3.9 Description of implementation of disruptive technology in the organisation with positive results

Organisation A provides a solution to the traffic department by using GPRS, which is an example of disruptive technology. The point-of-sale device enables the public to pay outstanding traffic fines when caught in roadblocks. Organisation A collaborated with a company in France to produce the “point-of-sale” machine. This “point-of-sale” device is powered by a car battery and is connected via GPRS to Organisation A. The GPRS transfers information to Organisation A allowing real-time bank transactions.

Another example by Organisation A is that they provide an alternative payment solution as a service to the community and KZN Department of Health. This initiative was the solution to a problem, experienced in the rural areas of Kwa Zulu Natal (KZN). Patients need to pay a clinic for services but cash is not readily available in the rural areas of KZN. Paying by cheque is also a problem as cheque fraud occurs frequently. Now, when a person has to pay the clinic for service, the person can request payment electronically. The request is forwarded to the KZN Health Department in Pietermaritzburg for authorization. If the person has enough money in his bank account, the transaction is authorised and the

amount is paid directly into the clinic's account. The advantage of this system is that electronic payment is easy, fast and cheque fraud is eliminated.

Satellite technology, used by Organisation B, is regarded as disruptive technology. Organisation B launched a project specifically developed for the rural areas in South Africa. It is called the "Branch in a box", because of the box-like structure. Organisation B uses satellites to send data from these branches in the rural areas and all transactions happen in real-time. Satellite technology is perceived as a disruptive technology which successfully replaced broadband which is dependent on cabling. This satellite technology is cheaper, very reliable and not prone to disruption due to cable theft. Transactions are quicker, it is more convenient for customers because the bank facility is closer to their homes, and the bank gained customers.

Organisation C described how the SMS functionality of cellular telephone technology (as a disruptive technology) is used for banking purposes. Cell phone banking is an example of the implementation of disruptive technology with positive results. The significance of this project was that it was aimed at a young market sector (20 years to 30 years), targeting those who are used to new technology and are cell phone keyboard literate. The project was a success as can be determined in terms of profitability.

3.3.10 Description of implementation of disruptive technology in the organisation with negative results

Organisations A, B and C described the methodology and procedures, followed within their respective banks to evaluate new technology. This is to ensure that the implementation of disruptive technology will not have a negative effect on the systems within the organisation. However, in certain cases, implementation of disruptive technology had a negative effect on the organisation.

Organisation A implemented telephone banking by using fixed line and cellular telephones for banking transactions. Telephone Banking however was not

successfully implemented by Organisation A. Two different options for telephone banking were described.

Telephone Banking Type 1: Phone Call Centre and request money transferral. A possible reason for failure was that clients may not want to communicate with others about personal matters, people often do not want others, even bank employees, to manage their money.

Telephone Banking Type 2: Using SMS functionality to initiate money transferral. Possible reasons for failure include the fact that SMS banking functionality is very slow, different types of cell phones require different functionality and interfacing, people perceive electronic banking using the cell phone as a risk.

Organisation B described the functionality available via the Internet as a disruptive technology. Their Capital Section implemented a functionality that allows qualifying customer's access to the Stock Exchange by using the Website. This product was originally aimed at a specific sector within the banking industry. However, for various reasons, the product was not successful and did not show profit. The bank changed its strategy and opened the product to other sectors in the banking industry, which made the product profitable within a year.

Organisation C described the implementation of Wi-fi functionality, which is also a disruptive technology. Wi-fi is used for connectivity between different workstations within the bank. Shortly after the implementation of the Wi-fi technology by a particular software provider, a hacker accessed the system and the organisation had to search for another product. Problems were encountered with the security of the business's information network and another software provider was contracted.

3.3.11 Investing in information technology

Organisations A and B indicated that a new technology could be utilised as soon as it becomes available on the market. Organisation B, on the other hand, takes a different strategy and will first investigate the functionality of the new product to

determine if the organisation will gain a competitive advantage by using the product. Organisation C indicated that it is highly unlikely for them to be the first to implement a product before it is available in the market.

Organisation A also first examines a new technology when it becomes available on the market. Organisation B tries to implement new technology before their competitors. If a competitor has already implemented the new technology and gained a number of customers, organisation B will investigate if implementing the new technology could be beneficial to the organisation in terms of profitability. Organisation C will not consider using a product as soon as it becomes available in the market.

Organisation A, B and C will investigate a new product, but will not purchase a product solely on the basis that a competitor has bought the product. The product has to be evaluated to estimate its value before purchasing. Organisation B evaluates the technology in terms of the current value network.

Organisation A and C indicated that it is not the norm to delay the investigation of a new technology and to wait and see the result of technologies implemented by their competitors. Investigation will be initiated to establish if the product or technology could ensure a competitive advantage. Organisation B used the SMS banking facility as an example where the organisation watched their competitors to identify problems encountered when interfacing with cell phone providers.

Pilot programmes are used to test new technology in the organisational environment. Organisation A will not always use the pilot technique, while Organisation B does not follow the “big bang” approach, but prefer using the pilot technique before the technology is rolled-out.

The three organisations have different viewpoints on when to buy disruptive technology and when to wait until it has been proven as best-practice technology. Organisation A and B will usually not wait until a new technology has been proven as best-practice, because their competitors could gain competitive

advantage. Organisation B will anticipate the result of a new technology that will be available (e.g. Microsoft), by proposing to test the technology. By testing the technology, Organisation B can be the first to implement the technology and ensure competitive advantage. Organisation C will investigate the new technology and, with sufficient information, a decision will be made whether or not a technology will be implemented.

3.3.12 Disruptive technology ensures shorter development time

Organisation A has found that the tedious evaluation process of new technology internally to the organisation required a different approach. By combining current technologies in a different way, new capabilities are provided which deliver better efficiency in a shorter development period. Organisation A has found that a tender process can also be tedious and very expensive. Organisation A described a case where tenders were requested for a service that would allow the KZN Department of Health the capability to print cheques over the Internet. The cheapest tender estimated the cost of development at R4.5 million and the shortest development time was estimated at 2.5 years. An innovative initiative launched by Organisation A developed the solution within 3 weeks at a cost of R350 000.00.

Organisation B has utilised satellite technology for the “Branch in a box” project. This ensured quicker implementation time, because no cabling was required.

The cell phone-banking project executed by Organisation C is a good example to illustrate technology implementation within a short development period. The easy-use capabilities of the cell phone technology allowed for a shorter development period.

3.3.13 The relationship between disruptive technology and profitability

Organisation A provided free Internet Banking during 1993 to attract customers to Internet Banking. This project secured financial growth for the business.

By using satellite technology, Organisation B was able to provide services to communities in rural areas. This enabled them to, a huge advantage in a new market sector before their competitors could enter this untapped area.

Organisation C was the first organization to provide speed-point technology to their corporate customers. This ensured the organisation a significant profitability.

3.3.14 Disruptive technologies enables opportunities for early and strong entry into existing and new markets

Organisation A described how GPRS is utilised with a combination of cash-box technology to provide a solution to their corporate clients, who ensured that organisation A retained their corporate clients.

Organisation B referred to the project where satellites were used to provide banking services to communities in rural areas, which ensured the competitive advantage.

Cellular telephones with 3G technology seemed to be a promising technology to Organisation C, however investigation proved that the technology is unreliable during peak call time in terms of data transfer. During peak call time, the cell phone service providers give preference to voice calls rather than transferring data.

3.3.15 Disadvantages of disruptive technologies as experienced in the business environment

3.3.15.1 Disadvantages of disruptive technologies in terms of customers/clients/employees resistance to new technology

Organisations A and C use new technology to attract new customers. Young people are not afraid of new technology and therefore are early adopters of new technology for banking services.

New technology is seen as a threat by older people, and they usually prefer doing banking in a more traditional manner. However, Organisation A has found that new technology provides empowerment to elderly people in rural communities, as they did not have these services previous. Organisation B

mentioned that the organisation must establish a trust relationship with their clients especially in squatter camps.

3.3.15.2 Disruptive technology could result in the delay of production and/or influence profitability

All three organisations emphasised that failure of disruptive technology cannot be tolerated. The change management process or evaluation processes that are in place ensure that disruptive technology will not be allowed to have a negative influence on profitability. However, Organisation C referred to a scenario where disruptive technology caused a delay in production due to unforeseen factors.

3.3.15.3 The negative effect of disruptive technology on change management

Most organisations use a change management process when implementing new technology to ensure that new technologies or new products will not have a negative effect. When new technology or a new product is implemented, all role-players are trained to ensure successful delivery of the system. However, the interviewee of Organisation A indicated that their executive management is reluctant to change because it is often deemed high risk.

3.3.15.4 Quantifying the financial investment of disruptive technology

Organisation A does not easily invest in disruptive technology, and would rather use external developments of disruptive technology, which will then transfer the relevant data to the organisation. Organisation B indicated that all technologies to be implemented needs to be quantifiable in terms of Rand value to capitalise the product. At the same time, the Return on Investment (ROI) has to indicate the value of the technology, thereby giving an indication if the project will be profitable.

Organisation C has derived significant financial advantage from implementing new technologies in comparison to other companies. Therefore, if a new product, properly motivated, indicates financial advantage, the organisation will approve implementing the new technology.

3.3.15.5 Exploiting disruptive technology to be profitable

Organisation A provides technological solutions to corporate clients by using disruptive technology externally to the organisation. Through these solutions, Organisation A ensures clients retention.

Organisation B used new technology to reach a designated sector in the banking industry to market product that gave them a competitive advantage.

Organisation C will not use new technology to exploit a product to make money from the product.

3.3.16 The relationship between the value network of the organisation and disruptive technology

The concept “value network” as described in the literature is not understood by the interviewees. Only after the researcher had explained the concept were interviewees able to respond. Organisation A interprets value network as value in terms of profitability and advantages to the organisation. Organisation B currently runs approximately 160 systems that integrate with in-house as well as external systems. Organisation B does not allow any technology that will negatively influence any of these 160 systems. Organisation B uses Services Orientated Architecture, which ensures that new technologies will interface with all 160 systems. Within Organisation C, different technologies have relationships with each other. If a new technology is under consideration and it is realised that the current system architect has to change to incorporate the new technology, Organisation C may view it favourably.

3.3.17 Considering sustaining technology as the preferred technology rather than disruptive technology

Organisation A and B prefer sustaining technology rather than disruptive technology. Sustaining technology has low risk factors and is a stable solution. Sustaining technology will not be replaced by disruptive technology just for the sake of implementing a new technology. Once again, all three organisations emphasised that new technology will be evaluated and have to be approved by a number of role-players before implementation will be considered. Organisation C requires the submission of a business when a new technology is considered for

implementation. The result of the investigation will determine if the new technology will replace the sustaining technology.

3.3.18 Retaining customers by providing innovative technology

Some municipalities are customers of Organisation A, which provides a payment kiosk service outside a municipality building. This means that people can pay their utility accounts without worrying about cashier hours. Added advantages include: municipalities do not have to handle cash, fewer cashiers are required, people can pay 24 hours per day 7 days a week, municipalities do not have to transport money and the risk of robbery is reduced. These kiosks are an enormous advantage to the municipalities, and ensured that the municipalities were retained as clients at Organisation A.

Organisation B was not only able to retain customers but gain new customers by launching the “Drive-Through-Banking” facility. Bank services have been provided by the “Drive-Through-Banking” in areas such as Lesotho and Swaziland. Customers simply drive their vehicles into a secured area and complete banking transactions.

Organisation C used the Speed-Point technology as an example where corporate customers were retained. This organisation was the first company to develop and launch the Speed-Point technology. Customers could not get the technology from any other provider, thus the customers were retained.

3.3.19 The impact of implementing disruptive technology causing organisations to lose customers

Organisation A emphasised that the cause of losing customers is not because of disruptive or innovative technology; instead they are of the opinion that the main cause of client loss is bad services or bad management.

Organisation B described a scenario where Internet Banking caused some customers to seek the services of their competitors. The Internet Banking facility provided by Organisation B did not provide sufficient functionality in comparison

to their competitors. Based on insufficient functionality, some customers were lost.

Organisation C argued that disruptive technology cannot be the cause of loosing customers. The company ensures that customers have the ability to choose between different services to support their banking requirements.

3.3.20 Using the S-Curve concept when researching disruptive technology

Organisations A, B and C are not familiar with the S-Curve concept. However from the previous answers to questions it may be deduced that the different organisations are aware of the fact that available technologies could be used to the benefit of the company or could be a threat to the company. The different organisations are constantly watching out for new technologies and consider the possible impact they can have on the organisation. Organisation A described earlier that an Innovation Department has been established to identify new technology that could be used to the benefit of the organisation.

3.3.21 The impact of disruptive technology when customers or executive management request functionality

Both Organisations A and B confirmed that customers request new solutions for specific requirements. Corporate businesses can be very demanding in their desire for banking services that are easier, safer and quicker to use.

Organisation C mentioned that executive management or the different service units within the organisation usually will initiate new ideas.

3.3.22 The impact of disruptive technology on the improvement of productivity and performance

Organisation A provides solutions to clients external to the bank. These solutions are not developed within the bank, but by external vendors or suppliers in conjunction with the bank. The information technology solutions feed data to the bank systems and transactions are executed in real-time. These solutions ensure that the client is satisfied and the bank’s productivity and performance is increased.

Organisation B emphasised that during the evaluation of a new technology the business case must include a motivation that the new technology will increase productivity and performance.

Organisation C described the scenario when Wi-fi technology was implemented. The purpose of implementing Wi-fi was to enable executive management to connect to internal systems, for instance e-mail or calendars, when roaming the different campuses of the organisation. The reason for implementing Wi-fi as a disruptive technology was not to increase profitability, but to provide accessibility to internal systems from any campus of the organisation.

3.3.23 The impact of disruptive technology on the security of the information technology infrastructure

Most organisations use the change management process as a standard procedure when new technology is considered. During the change management process, the impact of the new technology on the information technology infrastructure is investigated. Precautions are taken to ensure that the information technology is secured before a new technology is implemented. During the testing phase of the new technology, the security section of Organisation B will use techniques and methods to access the information system. The purpose of this exercise is to ensure that the information technology systems are secure and any hacking into the system is prevented.

Organisation C described the scenario where the authentication and encryption functionality had to be upgraded to prevent unauthorised Wi-fi access to their information system infrastructure.

3.3.24 The impact of disruptive technologies on standards and protocols developed by the organisation

The change management process is based on standards and protocols, which must be adhered to when a new technology is implemented. The change management process includes the approval by the organisation's network or architectural body of the new technology. Organisation B subscribes to ITEL and ISO to ensure that standards and protocols are upheld. Furthermore, the

Capability Maturity Model for Innovation (CMMI) department ensures that the standards are maintained as required by the bank during the lifecycle of a technology.

3.3.25 The impact of disruptive technology on business strategy

A business strategy for information technology is in place for the three organisations. These business strategies are intended to support the sustaining technologies and provide a road map for the rest of the bank. A business strategy for new technologies per se does not exist, but Organisation C emphasised that any new technology under consideration has to fit into the architectural framework of the organisation.

3.3.26 The involvement of executive management in terms disruptive technology

From the interviews held with Organisations A, B and C it became evident that executive management supports and encourages the concept of innovation in terms of information technology, as this supports the business and is the enabler for competitive advantage. Organisation A is very conservative in terms of change and enforces a change management process that should minimize any negative impact when disruptive technology is implemented to maintain their competitive advantage.

Organisation C mentioned that executive management does not dictate what technology should be used, but encourages systems that are universally used, e.g. e-mail system.

Executive management has, however, requested investigations into new technology for possible implementation, for example Black Berry. However, during the investigation phase it was found that the technology does not provide applicable functionality for the specific purposes required by the organisation. The result was that Black Berry was not implemented in Organisation C.

3.3.27 Evaluation processes for disruptive technology

A change management process is applicable when the implementation of new technology is considered or upgrading of technology is required. The change management process executed in Organisation A is time-consuming as different stakeholders and role-players have to approve the new technology. This process can take up to three years. Therefore Organisation A uses ouside entities to develop and implement disruptive technology, external to the bank, for their corporate clients. The clients use the disruptive technology and send data to Organisation A, where the transactions are completed. Organisation A uses technologies in a different manner or in a different combination to provide an innovative way of doing business.

From the interview with Organisation B, it is derived that the change management process is required before any new or upgrading of technology can be executed.

In contrast to Organisations A and B, no formal evaluation process for new technology is applicable in Organisation C. The business structure of Organisation C allows each business unit to implement its own change management processes. However all changes or additions to information technology have to be submitted to the architectural board for approval prior to the implementation of the technology.

3.3.28 The impact of disruptive technology when integrating with sustaining technology or used in combination with sustaining technology

The smooth integration of disruptive technology with sustaining technology is dependent on thorough investigation as indicated by Organisation A when describing the payment solution for the KZN Department of Health.

Organisation B indicated that if the new technology is not compatible with the sustaining technology, the new technology will not be implemented.

Organisation C used the Internet Banking project as an example where an implementation between disruptive technology and sustaining technology was

successfully executed. Internet Banking is an example where the front end was on a Microsoft web platform that integrated with the organisations' old IBM mainframe back end. The way the integration was done was disruptive and a breakthrough for integration between mainframe and Microsoft web platform.

3.3.29 The impact of disruptive technology on the organisations' humanistic approach

Organisation A, B and C ensure the use of information technology to provide services to all in South Africa, the general public, including those in rural areas, and corporate clients. When new technology is implemented or sustaining technology is upgraded, the organisations provide help functions to ensure that all their customers are able to use the services. From the interviews it is derived that these organisations follow a strategy to take banking services to the people instead of trying to attract people to come to the bank.

Organisation C follows a humanistic approach by providing bank services to a specific market sector, for example advertising bank services to young people on the website Facebook. Organisation C usually studies the specific market sector, for instance people in rural areas, identify their banking needs and provide information technology that provides solutions for these requirements. For example, cell phone banking technology can be used by people in rural areas (if cell phone coverage is available).

3.4 Conclusion

The research as documented in this chapter is based on a qualitative case study research methodology. The approach to the execution of the research is discussed. A questionnaire was used during the interviews with the three pre-defined organisations to collect information on the current state of the impact of disruptive technology in organisations in the South African business sector.

The analysis and interpretation of the interviews were presented and will be used to deduce conclusions and provide recommendations in the final chapter.

4. Conclusion

4.1 Introduction

The purpose of this chapter is to derive conclusions from the case studies on the impact of disruptive technologies on designated organisations within the information technology industry in South Africa. The conclusions will be applicable to identified problems and research questions will be answered from information gathered during the case study interviews.

The conclusions will be used to provide recommendations that can be followed by future and further studies.

4.2 Resolutions and stated problems

The main aim of this research was to establish the impact of disruptive technologies on organisations. Answers to stated problems were derived from the information gathered during the interviews with organisation A, B and C.

4.2.1 The awareness of disruptive technology in the business sector and how disruptive technology or innovative technology is handled

Only one organisation interviewed was aware of the concept disruptive technology. However all organisations are aware of new technology or innovative technology that can be utilised to give the company a competitive advantage. Organisations constantly seek ways to improve services to customers (internal users of the information infrastructure as well as external clients) to retain customers, or attract new customers or to be profitable.

Organisations accept that change in terms of information technology is inevitable and are aware that this ensures growth and productivity. Therefore organisations perceive change in terms of information technology as positive. Organisations will invest in new technology as soon as the product can be utilised to keep a competitive advantage. However, all new technology, under consideration for implementation, requires approval after the change management process has been executed.

4.2.2 Business value of disruptive technology

Organisations A, B and C acknowledge that information technology provides enormous value to the business as IT supports the core business of the business. Information technology has become one of the most important functions within the organisation. Disruptive technology is perceived as an advantage, because if implemented successfully and used before competitors, the organisation will have a competitive advantage.

4.2.3 Impact of disruptive technology on sustaining technologies

When an organisation considers implementing new technology, a motivation of the proposed technology has to be presented as a business case. The value of the technology is evaluated taking in consideration sustaining technology, the value network and profitability of the technology. If the new technology does not provide a strong business case, the sustaining technology will not be replaced. Sustaining technology is purposefully kept to minimize risk factors. If it is evident that the sustaining technology will be efficient for a period in the future, sustaining technology will be kept. However, if a business case proves that a new technology will be beneficial to the business, the sustaining technology will be replaced.

Sustaining technology is not always replaced by disruptive technology. Organisation A, B and C each provided examples of information technology solutions where disruptive technology has been successfully combined with sustaining technology.

Organisation A has reached the conclusion that the change management process can delay the required rapid development and implementation of information technology solutions. Organisation A, therefore, uses an alternative method to implement disruptive technology without undue waiting periods for approval. To stay ahead of competitors in terms of information technology development, Organisation A tasks outside service providers to develop disruptive information technology solutions to maintain a competitive advantage.

Organisation A then updates their systems using the data received from the external information technology solutions. This method of working allows Organisation A to use disruptive technology without impacting sustaining technology of the company.

4.2.4 Impact of disruptive technology on current hardware and software architecture

A business case motivating the implementation of new technology has to be submitted to an approval body in the organisation. The approval body consists of different role-players from the business functions side of the business as well as the information technology section. All role-players evaluate the functionality of the new technology and verify if the new technology will fit into the value network. The outcome of the approval body will provide a decision on the implementation of the new technology. However, if the business case indicates that the new technology will more beneficial to the company and advantages outweigh other considerations, the current hardware and software will make allowances to changes.

4.2.5 Impact of disruptive technology on organisational business processes and procedures

The organisational business processes and procedures are defined by the different business functions of the organisation. During the approval phase of a new technology, changes that impact the business processes in consideration are made. During the change management process, the revised or new business processes and procedures are implemented. The change management process includes testing of the system, advertising of the system, and training on the system.

4.2.6 Impact of disruptive technology on services provided to customers/clients of the organisation

Organisations A, B and C rate the quality of services to customers or clients very higly, because customers and clients provide profit to the company. When new technology is implemented, the different organisations have to ensure that services to the customers are not disrupted.

The three organisations all emphasised that they provide services to a wide range of customers, including corporate clients, people living in the cities, people living in rural areas, customers from different age groups. When new technology is implemented, the different organisations ensure that all customers are able to use services in the manner that they prefer. The organisations need to retain their current customers, but to ensure growth, the organisations need to attract new customers.

Customers will occasionally request organisations to provide new services that will improve transactions, improve security and improve functionality. Therefore, the different organisations are constantly seeking new technologies or new ways of providing services to satisfy the requirements of their clients.

4.2.7 Impact of disruptive technology on the security and control of the information of an organisation

Organisations A, B and C are aware of new technologies that can be used to access internal systems illegally. Disruptive technology (e.g. Bluetooth) is used to test the firewalls to establish if access to internal systems is possible. During the change management process, technology is tested to verify the robustness of the security of the systems. If disruptive technology is a threat to the security of the internal systems, the firewalls or authentication and encryption functionality has to be upgraded.

4.2.8 Impact of disruptive technology on the business strategy

Research indicated that information technology is very important to the organisations as IT supports the core business of the organisation. The business strategy of the organisation relies on the information technology section's strategy. In instances where disruptive technology is implemented, the business strategy is changed to incorporate the adapted IT strategy.

Executive management has realised the importance of disruptive technology to maintain a competitive advantage, and therefore urges the information technology section and other employees to propose new solutions that can be

utilised to the benefit of the company. One interviewee mentioned that the organisations' top management is reluctant to change and perceives change as a risk. Information technology solutions are developed externally to the organisation to satisfy the requirements of clients. In this instance, disruptive information technologies are applied in a manner that does not hold a threat to the organisation, but are developed and implemented to the benefit of the organisation.

In conclusion, it can be stated that the hypothesis stated is true in the sense that organisations are aware of the business value of new, innovative or disruptive technology and that organisations can attain and maintain their competitive advantage if the technology is utilised sufficiently.

4.3 Recommendations

Businesses are aware of the value of information technology, but should be made more aware of disruptive technology particularly how it can be utilised to the advantage of the organisation (Patki, 2006:18). In the banking environment, the services provided by one organisation are more or less the same as services provided by the next organisation. The organisation that strives to differentiate itself from competitors uses the capabilities of technology to keep a competitive advantage, as described by Organisation B. Conceptualising and visualising the potential of disruptive technology can improve enhancement in services and products. Creativity in terms of information technology or the combination of different technologies ensures growth and development of the organization, as described by Organisation A.

Although disruptive technology claims to have advantageous characteristics, such as easy to use, shorter development time, etc, it is important that organisations evaluate the specific disruptive technology to ensure return on investment (Dhar & Sundararajan, 2007:127). Disruptive technology proposes better functionality than sustaining technology and provides functionality that cannot be provided by sustaining technology (Nault & Vandenbosch, 2000:305).

Emerging technology must be evaluated to determine if the technology is ready for production, how the technology will fit into the value network and how the new technology will be applied to establish a level of confidence within the firm as well as among customers and partners (Evans, 2003:9). Indeed, the empirical research showed that disruptive technology must be tested before it is implemented in an organisation. Even if executive management demands rapid implementation a new technology, the process of controlled change management will ensure that the technology is tested and validated before it is implemented.

Information technology is an enabler for businesses to be competitive but companies should be prepared to reinvent themselves and be able to use disruptive technology; this is the key to survival (Patki, 2006:18). Companies should provide an environment in which employees can propose and explore new ideas and new technologies. Organisation A stated that it is the mavericks and creative thinkers in the organisation who explore the usability of new technology to provide information technology solutions that will be beneficial to the organisation. Executive management should value these individuals as their input allows the organisation to maintain its competitive advantage.

Evans (2003:2) differentiates between organisations in terms of mainstream businesses that prefer using sustaining technology, and early adopters, that are smart movers who do not hesitate to implement disruptive technology to keep a competitive advantage. However, the organisation that can utilise disruptive technology, within the right business units, with the right opportunities at the right time (Evans, 2003:2), will have a competitive advantage and will be successful. Evans' argument was supported by individual interviewees from the three participant organisations. Organisation C mentioned that the different business units are responsible for their own research and development in terms of innovative information technology. Organisation B pointed out that the organisation will not always implement disruptive technology for the sake of being innovative. The process of change management has to be followed before a new technology will be implemented and replace sustaining technology.

Management is regularly confronted with the issues and problems associated with technology and accommodating innovations. Technology has become a high priority resource in any firm, and requires good management in order to provide a firm with a competitive advantage (Burgelman, 1996:1). Therefore the management of technology has to be part of a firm's strategic planning. The empirical study showed that the business strategy of the information technology department within an organisation becomes a lodestar for the business strategy of the organisation.

The nature of technology is constant change, which enables the firm to keep a competitive advantage. Therefore the management of a firm has to determine how new technologies and innovations will lever or improve capabilities to support the drive for a competitive advantage (Burgelman, 1996:2).

4.4 Future and further studies

The research conducted was aimed at a number of organisations in the banking industry. The same research can also be applied to case studies in other market sectors in the South African context.

Disruptive technology is subject to changes, challenges, uncertainties and constraints. The development process of disruptive technology should be studied in conjunction with risk management or strategic management to enable management to make more informed decisions.

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Annexure A: Questionnaire

A.1 Questionnaire used during interviews with organisations

A.1.1 Purpose of the Case Study

The purpose of this case study is to gather information relevant to the research topic and applicable to South African businesses. Interpretation of the research and information gathered will be documented as research results. The research is conducted to complete the degree MIT at the University of Pretoria, Faculty of Engineering, Build Environment and Information Technology.

A.1.2 Subject of Research for Case Study

The impact of disruptive technologies on designated organisations within the IT industry in South Africa

A.1.3 Content of Questionnaire

The following questions will be presented to the interviewee during the execution of the case study:

Annexure A:Table 4: Questionnaire

Number of Question	Description of Question	Notes and answers to questions
1	Is your organisation aware of Disruptive Technologies or is another term used for the same concept?	
2	How does the company handle change in terms of technology?	
3	What is the business value of information technology within the company?	

4	Rank the following from the most important aspect to the least aspect in terms of information technology in the company? 1- Productivity must be improved; 2- Costs must be reduced; 3- Revenues must be increased; 4- Shareholder value can be increased; 5- Customer loyalty and satisfaction can be increased 6- Reduce risks or pitfalls.	
5	What is the relation between profitability/competitive advantage and information technology?	
6	How does the company perceive new technology (advantage or threat)?	
7	How easy is it that the company will start using a new technology realizing that sustaining technology may be replaced?	
8	How would the company define the characteristics of disruptive technology?	
9	Describe when the company has implemented disruptive technology with positive results and what were these positive results?	
10	Describe when the company has implemented	

	disruptive technology with negative results and what were these negative results?	
11	At which stage does the organisation invest in new technology when it becomes available? As soon as the product can be utilised (before available on the market); As soon as the product is available in the market; If other competitive companies buy the product, this organisation will also purchase the product; Delay investing in (purchasing) the product. Wait to see the result of trails done by other companies before purchasing the product. Arrange pilot project to test new technology in organisational environment. Never buy disruptive technology; must be proven as best-practice technology.	
12	Describe a scenario where a disruptive technology has provided new capabilities in a shorter development period.	
13	Describe a scenario where disruptive technology secured profitability for fast financial growth for the business.	
14	Describe a scenario where disruptive technologies	

	promised opportunities for early and strong entry into existing and new markets.	
15	Describe disadvantages of disruptive technologies as experienced in the business environment. The following may be used as guidelines: Customers/clients/employees resist the new technology. The implementation of disruptive technology could result in the delay of production and/or influence profitability. Negative effect on change management. Quantifying the financial investment of disruptive technology. Motivate the value of disruptive technology to exploit the product for profit.	
16	How does the company see the relationship between a value network and disruptive technologies?	
17	When the company has to decide between implementing disruptive technology or continue using sustaining technology, which will be preferred in the particular company?	
18	Has it happened that customers have been retained because of implementing new innovative technology?	

	Provide a description if applicable.	
19	Has it happened that the company has lost customers because of the implementation of new innovative or disruptive technology?	
20	Does your company use the S-Curve concept when researching disruptive technology or sustaining technology? Describe your answer?	
21	Was disruptive technology introduced to the company by requests from the customers?	
22	Has the company experienced real improvement of productivity and performance since disruptive technology has been implemented in the organisation?	
23	How does the security on the information system infrastructure ensure that disruptive technology will not influence the current information infrastructure?	
24	Has your company developed information technology environment standards and protocols to ensure quality and standards of information technology hardware and software, which will influence the decision to be made on implementing disruptive technologies?	
25	Does the company follow an approach or use a business strategy to handle disruptive technology? (IT business unit should continuously be aware of emerging technologies, be aware of the	

	requirements and business needs of the different business units within the company, changes in needs of customers, other business partners and the industry.)	
26	What is the involvement of executives and management?	
27	Does the company follow a process when evaluating disruptive technology? The following can be used as examples: Maturity level of the technology in the market; Unreliable vendor products; Outcome of implementation is too uncertain; Usability of technology in company.	
28	Describe a scenario during which disruptive technology was integrated with sustaining technology or implemented to be used in combination with sustaining technology?	
29	What is the humanistic approach during the consideration and/or implementation of disruptive technology? (Change management; feasibility studies to verify if disruptive technology will be suitable for customers.)	

A.2 Case Study Fact Sheet

A.2.1 Introduction

The fact sheet contains an interpretation of the answers provided by the interviewees of the different organisations In some instances the terminology of the interviewees has been used. Each question is numbered and the answers provided are presented as Organisation A or Organisation B or Organisation C. The audio tapes containing the actual interviews are available for reference purposes.

Annexure A: Table 5: Case Study Fact Sheet

Number of Question	Description of Question	Notes and answers to questions
1	Is your organisation aware of Disruptive Technologies or is another term used for the same concept?	ORGANISATION A: Organisation A is well aware of the concept “Disruptive Technology”. The interviewee emphasised the difference between innovation and disruptive technologies. Technologies can be innovative but are not necessarily disruptive. Disruptive can also mean that technology is used in a disruptive way influencing the way business is done. The interviewee has the opinion that Organisation A is one of the world leaders in using information technology in the banking sector. The

		organisation is aware of disruptive technology, understands why it is good for the organisation and knows that using disruptive technology will provide a competitive advantage. ORGANISATION B: The concept disruptive technologies are not used within this bank environment, but the bank is aware of new technology and seeks ways of implementing it to get a competitive advantage. ORGANISATION C: The interviewee is not familiar with the term disruptive technology, but having understood the explanation provided by the researcher, the interviewee realised that these technologies have been used extensively in the bank.
2	How does the company handle change in terms of technology?	ORGANISATION A: All business units within Organisation A are supported by information technology. Change is inevitable and ensures growth and productivity. Therefore change in terms of technology is perceived as positive. Organisation A recognises that disruptive technology is an important

		aspect for the growth and prosperity of the company. An Innovation Department exists within Organisation A with the purpose to promote innovation. This department provides a website where employees can submit ideas how Organisation A can improve services. Structured processes and procedures and red tape influences the implementation cycle of new products and ideas. The bank has four software releases per year. If a new solution or software application needs to be implemented, the proposal has to be submitted well in advance. A change management process makes provision for evaluation of the technology to establish the effect on other systems used by Organisation A (interfacing with internal as well as external systems). Approval of different departments is required when new software will be launched. After approval from the different departments, approval from the different system heads is required for software implementation. Organisation A follows another approach when using innovative technology. Innovative solutions are created outside the bank, developed outside the bank by outsourced companies, which do not interface with internal information technology systems. These solutions are created for clients of Organisation A. These clients create Flatfiles, which are sent to

		Organisation A. The Flatfiles are used to update the system and no interfacing is required. Disruptive Technology is used outside the Bank systems, but Flatfiles are used to update the Bank system. Although all information technology is not disruptive in its own sense, the combination and solution provided is disruptive. ORGANISATION B: Organisation B developed and implemented a Change Management process, which is mandatory to all information technology processes. Each new technology has to be approved by the Change Forum. Change is inevitable but processes are in place to handle change. ORGANISATION C: Technology is used as a business driver. If technology has been identified as potential technology to be used in the bank, Organisation C will adopt it or at least investigate the new technology. The bank will not simply adopt the technology because it is new. A business case is required to determine whether the technology will be beneficial to the business.

3	What is the business value of information technology within the company?	ORGANISATION A: The core business of the bank is dependent on Information Technology. The bank cannot function without information and all data is embedded on Information Technology. ORGANISATION B: It is required by the bank that a business case is prepared that provides the motivation to implement new technology. The business case must provide ROI (Return on Investment) and a Net Present Value. The values of these measurements must provide a positive result. The bank sees the business value of information technology as highly important and budgets for information technology at six million per year, which could be increased in the following year. If a project does not indicate business value to the business, the project will not be approved. If a project needs to be done because of regulations set by the government, the business will seek ways of providing the best possible solution to satisfy the requirements. ORGANISATION C:

		Technology is an enabler. Technology can be used by the business to be competitive. It depends on the type of technologies and the capabilities, which will be utilised for a specific service.
4	Rank the following from the most important aspect to the least aspect in terms of information technology in the company? 1- Productivity must be improved; 2- Costs must be reduced; 3- Revenues must be increased; 4- Shareholder value can be increased; 5- Customer loyalty and satisfaction can be increased 6- Reduce risks or pitfalls.	ORGANISATION A: – 4 Shareholder value to be increased is always the most important aspect to keep in mind when implementing Disruptive Technology. – 5 Information technologies must be utilised to attract more customers for the business and to retain customers to ensure profitability. – 2 Costs must be reduced. – 6 Risks or pitfalls must be reduced to the minimum when new technology is implemented. – 1 Information technology supports all aspects of Organisation A, therefore productivity must also be improved. – 3 Information technologies must support business to increase revenues.

		ORGANISATION B: 1 – 5 Customer satisfaction is top priority and systems will be changed as long as the bank can retain or get new customers. 2 – 4 Profitability is important to shareholders. 3 – 6 The bank recognises the potential risks and pitfalls that can be present when implementing a new technology. 4 – 1 The information technology must ensure that the productivity of the worker will be improved. 5 – 2 To be profitable costs must be reduced. However technology is expensive 6 – 3 It is a requirement that each project has to increase the revenue. ORGANISATION C: 1 – 3 Increase in Revenues 2 – 4 Shareholder value can be increased

		3 – 1 Costs to be reduced 4 – 2 Productivity to be improved 5 – 5 Customer loyalty is dependent on good customer service and not necessarily disruptive technologies. 6 – 6 Reduce risks or pitfalls.
5	What is the relation between profitability/competitive advantage and information technology?	ORGANISATION A: The only way of retaining competitive advantage is to use information technology in such a way, which is more advanced than the information technology used by other banks. ORGANISATION B: The result of competitive advantage is profitability. Information technology ensures that the bank will keep a competitive advantage. All products and services that can be provided by a bank, is also provided by Organisation B. The only difference between Organisation B and its other competitors is the technology it is using to keep a competitive advantage.

		ORGANISATION C: If the purpose is to be profitable then the interviewee expected that new technology may be utilised for that reason. Disruptive technologies are also used to improve the way people work which does not have a direct influence on competitive advantage. For example, Wi-Fi is used to enable employees to have access to applications on the network from different campuses of the bank. Wi-Fi does not provide a competitive advantage in the sense of financial gain, but it does make working in the company easier.
6	How does the company perceive new technology (advantage or threat)?	ORGANISATION A: The interviewee perceives new technology to be an advantage for the bank as a whole. Disruptive technology is not a threat to the systems of Organisation A, as advanced firewalls prevent any access to internal systems of Organisation A, e.g. wireless technology. Disruptive technology is a threat to the people inside the bank, as it changes procedures within the bank. This implies that people have to change the way they work.

		Disruptive Technology can be a risky business. Organisation A invested in this area by sending a group of people on a course on Disruptive Technology. However, many of these employees who attended the course, have resigned. ORGANISATION B: Organisation B perceives new technology as an advantage. Executives and management require solutions from the information technology department to provide satisfactory services to the client. Designated employees are tasked to be aware of new technology and how it can be utilised by the bank. New technology is perceived as important for the growth of the bank to keep a competitive advantage and technology is important to provide services requested by clients. If the software is not available at the bank, the bank looks for technology that will support the requirements of the client. ORGANISATION C: Some new technologies can be advantageous while others can be a

		threat. Wi-fi and 3G can be serious security threats, which is a risk to the company. The bank has to investigate and implement solution to ensure that a disruptive technology is not a threat to the business, but can be utilised in a positive way. The interviewee does not perceive disruptive technology as a threat to employees, because the younger generation is used to technology and can adapt easily.
7	How easy is it that the company will start using a new technology realising that sustaining technology may be replaced?	ORGANISATION A: Organisation A realises the importance of new technology, but it is an extensive process to implement it, taking into account the approval process and the long evaluating procedure within the organisation. ORGANISATION B: Organisation B uses systems for different purposes and will use a system that is reliable and cost effective. A new technology that could replace sustaining technology will be thoroughly evaluated before it will be considered as a replacement. Furthermore, Organisation B will usually customise or modify an information system software solution to

		be applicable to the Organisation B requirements. Therefore it is difficult to upgrade these systems because of the customisation. In this case, Organisation B will prefer using the sustaining technology. Organisation B runs a number of legacy systems that needs to be replaced by new technology. Organisation B will replace older systems if the system becomes unstable, or developers become unavailable or the system cannot interface with other systems. If there is no proof that new technology will be better than the sustaining technology, the new technology will not replace the sustaining technology only to be faster or provide quicker response-time. ORGANISATION C: The decision for disruptive technology or new technology is based on the business case. If the business case proves that the new technology will replace the old or current technology, the new technology will be adopted.
8	How would the company define the characteristics of disruptive technology?	ORGANISATION A: Disruptive technology can be defined as “using new technology that disrupts the way the bank is working or using current technology in a

		different way, which disrupts the market place". ORGANISATION B: Internet banking necessitates training for all relevant parties to use the updated system. One of the criteria, which are used to evaluate disruptive technology, is to test how easily the customer will understand the disruptive technology and if the technology will be more convenient to use. Users need to feel comfortable when using the new technology. The bank cannot tolerate an information technology solution if the product is unpredictable. Therefore the bank will test and evaluate disruptive technology until any possible unpredictability has been identified and the system becomes stable. The change management process as conducted by the bank when implementing a new information technology makes provision for thorough testing and evaluation of the product before it is implemented. Wireless is a threat to the Organisation B systems because it can be used to access Organisation B system. Bluetooth is also a threat to the information technology systems of the

		bank. With Bluetooth one can connect to a PC if the Bluetooth functionality is activated. If the PC is connected to the information technology systems of the bank, access will be able with Bluetooth. Security systems should be upgraded to ensure that the firewalls will not allow access with wireless or Bluetooth. ORGANISATION C: One of the accepted advantages of disruptive technology is that it is easier to use, but it is not true for all cases. It has been found that users who are not familiar to technology tend to struggle when using new technology. Another characteristic is that disruptive technology is cheaper. According to the interviewee this is not always the case. Typically, it is the support costs that are high and not necessarily the development cost.
9	Describe when the company has implemented disruptive technology with positive results and what were these positive results?	ORGANISATION A: Organisation A described a scenario where disruptive technology was used with positive outcome. Innovative information technology development enabled a link between PC's and a mainframe. This

		technology was developed for Organisation A during the 1970's. Organization A started using PC's to work out the high payment of fleet purchases. Data was captured on PC's, which were connected with the mainframe. The captured data was the input directly into the mainframe. Organisation A: Cheque payment solution: Organisation A provides a cheque payment solution as a service to the community and KZN Department of Health. This initiative was the solution for the problem which exists in the rural areas of Kwa Zulu Natal. Patients need to pay a clinic for services but cash is not available in the rural areas of KZN. Paying by cheque is also a problem as cheque fraud occurs frequently. If a person has to pay the clinic for service, the person requests payment electronically. The request is forwarded to the KZN Health Department in Pietermaritzburg where the credibility of the requester is authorised. If the person has enough money in his bank account, the cheque is authorised and paid directly into the account of the clinic. The advantage of this system is that electronic payment is easy and quickly and cheque fraud is eliminated. Organisation A: Solution for payment of speed fines solution for the

		traffic department: Organisation A provides a solution to the traffic department with the "point-of-sale" machine manufactured by a company based in France. The battery of the car provides the power for the point-of-sale device, which is connected with GPRS. The point-of-sale device enables the public to pay traffic debts when caught in roadblocks. The GPRS transfers information to Organisation A allowing real-time bank transactions. ORGANISATION B: A successful project used satellite technology that enabled the previously "un-banked" customers to use bank facilities in the rural areas. Organisation B described the "Letter of Credits" project which uses the technology available in the USA. The process includes the capturing of data of corporate information, the data is sent to the USA where the processing and credit worthiness are validated. The result of the processing is sent back to Organisation B. The advantage of this process is that the client can have a result within 2 days, whereas

		previously this process took 2 weeks to be finalised. Organisation B launched a project specifically developed for the rural areas in South Africa. It is called the “Branch in a box” which refers to a branch of Organisation B being deployed in a box-like structure. Organisation B uses satellites to send data from these branches in the rural areas and all transactions happens in real-time. Satellites as a disruptive technology are successfully used to replace broadband which uses cabling. Transactions are quicker, it is more convenient for customers because the bank facility is closer to their homes, and the bank gained customers. It is cheaper to use the satellite technology than cabling technology. ORGANISATION C: Cellphone banking was an implementation of disruptive technology with positive results. The SMS functionality of a cellphone is used for banking. The project was aimed for the younger generation (20 to 30 years) in the market sector. This market sector is used to new technology and is cellphone keyboard literate. The project was a success and this could be determined in profitability.

10	Describe when the company has implemented disruptive technology with negative results and what were these negative results?	ORGANISATION A: The extensive evaluation process and red tape mechanisms within Organisation A do not allow any implementation of technology with negative results. Organisation A uses innovative ways of delivering services that can be used by the Departments or public or businesses that do not interface directly with the internal systems of Organisation A, and therefore cannot have a negative effect on the systems within Organisation A. Telephone banking is one technology that could as yet be not be launched successfully for Organisation A. Internet banking enables the connection from PC's to Internet for banking transactions was successful. Telephone banking however was not successful yet. Telephone Banking Type 1: Phone Call Centre and request money transferral; possible reasons for failure are that people do not want to communicate with others about personal matters, clients do not want other people to manage their money. Telephone Banking Type 2: Using SMS functionality to initiate money transferral. Possible reasons for failure is that the SMS banking

		functionality is very slow, different types of cell phones require different functionality and interfacing, people perceive electronic banking using the cell phone as a risk. ORGANISATION B: The Change Management process is implemented to ensure that no system will be implemented with negative results. The bank has processes, which have to be followed when a new technology or product is implemented. These processes include feasibility studies, business cases that have to be delivered and approved, pilot projects and lengthy evaluations of the technology or product. Example: The Capital Section has implemented a functionality, which allows customers to have access to the Stock Exchange by using the Website if the customers qualify. This product, supported by new technology, was aimed at a specific sector in the banking industry. However, the product was not successful for various reasons and profit was not made. The bank changed its strategy and opened the product to other sectors in the banking industry, which made the product profitable only one year later.

		ORGANISATION C: Wi-fi is used for connectivity between different workstations within the bank. Shortly after the implementation of the disruptive technology Wi-fi by one vendor, the system was cracked and the organisation had to search for another product. Problems were encountered with the security of the business's information network. To resolve this problem, Organisation C changed to another software provider to solve the problem.
11	At which stage does the organisation invest in new technology when it becomes available? As soon as the product can be utilised (before available on the market); As soon as the product is available in the market;	ORGANISATION A: Investing into technology is a possibility for numbers 1 or 2 or 3. Organisation A will never follow number 4 to wait and see the result of technologies. This organisation will initiate investigations to establish if the technology will ensure a competitive advantage. Pilot projects as described in number 5 are sometimes executed. Number 6 is not true for Organisation A. The organisation will quickly investigate the disruptive technology to establish if the technology will be

	If other competitive companies buy the product, this organisation will also purchase the product; Delay investing in (purchasing) the product. Wait to see the result of trails done by other companies before purchasing the product. Arrange pilot project to test new technology in organisational environment. Never buy disruptive technology; must be proven as best-practice technology.	beneficial to the company. ORGANISATION B: 1 – If possible Yes because it can give the bank competitive advantage. 2 – Usually not, if another bank has launched a product one week before Organisation B, it defeats the object to implement the product one week after and the other bank has gained a number of customers. Organisation B tries to implement a product before other banks to keep a competitive advantage. 3 – Not necessarily; the product has to fit in with the value network of the current systems within the bank. 4 – Yes for example the SMS banking facility. Organisation B watched the other banks to see which problems would be encountered interfacing with cell phone providers. 5 – Yes, when planning to launch a new product, a pilot will be used to test the success rate of the product. Organisation B does not follow a big bang approach, but will pilot in designated branches before the product

		is rolled out to all branches. 6 – Organisation B cannot wait until a new technology has been proven as best-practice, because the other banks which are using the technology will already have gained the competitive advantage. If Organisation B has information regarding a new technology that will be available (e.g. Microsoft), Organisation B will propose to test the technology. By testing the technology, Organisation B can be the first to implement the technology and ensure competitive advantage. ORGANISATION C: 1 – Highly unlikely will this organisation use a product, which has not been proven and only be utilised. 2 – Organisation C will not consider using a product as soon as it becomes available in the market. 3 – Organisation C will not purchase a product only because its competitor has bought the product. The product has to be evaluated to estimate the value of the product before it will be purchased. 4 – It is not the norm for Organisation C to wait for results from their

		competitors before investing in technology. Trials will be executed by the company itself and evaluation will be done before investment will be done. 5 – Arrange a pilot project to test the technology in the organisation's environment. If it is successful it will be rolled-out. 6 – Organisation C will investigate the new technology and with enough information a decision will be made whether a technology will be implemented or not.
12	Describe a scenario where a disruptive technology has provided new capabilities in a shorter development period.	ORGANISATION A: Because of the long procedure of evaluating new technology and the long approval process to implement new technology, Organisation A uses the concept of disruptive technology in a new way. By combining current technologies in a different way, new capabilities are provided which delivered better efficiency in a shorter development period. Organisation A requested tenders for the service to provide KZN Department of Health the capability to print cheques over the Internet. The cheapest tender estimated the cost of development at R4.5 million

		and the shortest development time was tendered for 2.5 years. An innovative initiative launched by Organisation A developed the solution within 3 weeks at a cost of R350 000.00. ORGANISATION B: New technology has been developed by the bank by in-house software developers, which enables the bank to test new systems in a shorter time period. The project, which is using satellite technology ensured quicker implementation time, because no implementation of cabling was required. ORGANISATION C: The cell phone-banking project is a good example to illustrate technology implementation within a shorter development period. It was due to the easy-use and capabilities of the cell phone technology that enabled a shorter development period.
13	Describe a scenario where	ORGANISATION A:

	disruptive technology secured profitability for fast financial growth for the business.	Organisation A provided Internet Banking free of charge during 1993 to attract customers. This project secured financial growth for the business. Other examples: Pre-paid electricity solution; Money Security Solution at Johannesburg Market; Cheque payment solution for the KZN Department of Health ORGANISATION B: By using the satellite technology Organisation B was able to provide services to communities, which ensured gaining a market sector before other banks could enter the market sector. Technology enables the bank to provide a hand-held device for credit card transactions. This technology ensures the security of credit card transactions, which improves reliability to the customers. ORGANISATION C: Organisation C was the first organization to provide speed-point

		technology to their corporate customers, which gave the organisation significant profitability. The speed-point technology ensured the company a competitive advantage.
14	Describe a scenario where disruptive technologies promised opportunities for early and strong entry into existing and new markets.	ORGANISATION A: Organisation A provides services to Johannesburg Market. The market buys and sells products, which implies that money is exchanged. The market is constantly under threat of robberies. Organisation A provides a solution that enables Organisation A's client to secure the money in containers. The money is counted, placed in the containers, then the client transmits the relevant data to Organisation A and the client's account is immediately updated. The containers are designed in such a way that the money will be damaged if the container is moved without activating a certain device built into the container. The advantage of this solution is that the client has a designer container to protect the money, has electronic transfer of data using GPRS (not Telkom lines) to update his account in real-time. The client's account is credited whilst the money is still on the premises of the client. GSM was been used before the GPRS functionality became available. GPRS is a cheaper solution with speedier communication capabilities. The Organisation A provides the

		client with a service, which ensures security for money handling. If something happens to the actual cash, Organisation A will handle the crisis in terms of their risk management, which is part of the service. This service ensures that the client will prefer banking with Organisation A rather than with the competitors. ORGANISATION B: The project where satellites were used is a good example of technology, which ensured the competitive advantage for Organisation B. ORGANISATION C: Cell technology with 3G technology seemed to be a promising technology, but investigation proved that the technology is unreliable during peak call time. During peak call time, the cell phone service providers give preference to voice calls rather than transferring data.
15	Describe disadvantages of disruptive technologies as experienced in the business	ORGANISATION A: Young and early adopters want to use the new technology as that is a way of attracting new customers. New technology is also a threat to

	environment. The following may be used as guidelines: Customers/clients/employees resist the new technology. The implementation of disruptive technology could result in the delay of production and/or influence profitability. Negative effect on change management. Quantifying the financial investment of disruptive technology. Motivate the value of disruptive technology to exploit the product	elderly people, as they usually prefer doing banking in a way that is comfortable for them. However, elderly black people often enjoy new technology, because it allows them to access services they did not have in previous years. Organisation A will not allow failure of disruptive technology to cause a delay in production or have an influence on profitability. The long approval process for new solutions is in place to ensure a successful outcome. Management of Organisation A is reluctant to change because of high risks that need to be taken into consideration. However when a new solution is implemented, all roll-players are trained and educated to ensure successful delivery of the system. Organisation A does not invest in disruptive technology. Disruptive technology is used outside the bank to its benefit, and Organisation A derives value from disruptive technology by providing services to clients that ensure that Organisation A retains its clients. These services sometimes use disruptive technologies or the combination of technologies provides a disruption in the way Organisation A is doing

	for profit.	business. ORGANISATION B: Customers, clients and employees resist new technology in the Organisation B environment. Employees tend to use old systems because they are familiar with the system. Therefore Organisation B usually removes the old system completely and deploys the new system to ensure that all new transactions will be done on the new system. Clients living in the rural areas or in squatter camps do not trust the process of banking with a card. In some instances, clients still need to use bank books, which are used to keep track of transactions. Older clients experience technology as intimidating while the younger generation accepts technology more easily. Disruptive technology will never have an influence on or delay in productivity. Organisation B uses a Change Management process that ensures that technology is well tested before the technology is implemented. The purpose of the Change Management process is to ensure that new

		technology will not have a negative effect. Before Organisation B implements a new technology, all users are trained. All technologies to be implemented at Organisation B have to be quantifiable in terms of Rand value to capitalise the product. On the other hand, the Return on Investment (ROI) has to indicate the value of the technology to ensure that the technology is quantifiable, but it is difficult to quantify is market risk. Organisation B will use new technology to reach a designated sector in the banking industry in order to market another product to gain competitive advantage. ORGANISATION C: Cell phone banking was aimed at users in the age group between 20 and 30 years. These users are used to technology and adapt easily to new technology. Other users tend to resist new technology. Some people still will not use an ATM (Automated Teller Machine) and others do not trust the Internet Banking functionality. Delays in production have happened when rolling out new technology in

		previous years. Unanticipated factors occurred during the testing phase, which forces the delaying of the implementation of new technology. Delaying of the production has an effect on profitability in the sense that if the product is not available, the customers will not use it and the company will not have an income deriving from the technology. Using of cell networks for outline branches could be used instead of Telkom networks, which as seen to be rather unreliable. If the new technology is implemented, all users need to be trained. In some instances the company has derived significant financial advantage from implementing a new technology compared to other companies. Organisation C will not use new technology to exploit the product to make money from the product.
16	How does the company see the relationship between a value network and disruptive technologies?	ORGANISATION A: Disruptive technology must provide value and advantages to the customers to ensure that the customers will be willing to use the technology.

		ORGANISATION B: Organisation B currently runs approximately 160 systems that integrate with in-house as well as external systems. Organisation B does not allow any technology that will negatively influence any of these 160 systems. Organisation B uses the Services Orientated Architecture, which ensures that new technologies will interface with all 160 systems. ORGANISATION C: The organisation is not familiar with the term Value Network. Within the organisation different technologies have relationships with each other. If a new technology is investigated and it is realised that the current system architect has to change to incorporate the new technology, Organisation C will consider it.
17	When the company has to decide between implementing disruptive technology or continue using sustaining technology, which will be preferred in the particular	ORGANISATION A: Organisation A usually uses sustaining technology to keep risk factors low. Disruptive technologies will be used outside the company in an innovative way that will provide advantages to the customer but also retain the customer of the bank.

	company?	ORGANISATION B: Organisation B uses a strategy guideline, which provides a map of the goals of information technology. New technology is evaluated against sustaining technology using the information technology strategy as a guideline. If the sustaining technology will be efficient for the following period (3 years), then sustaining technology will be the preferred technology. New technology is not always used just for the sake of new technology; it has to add value to the bank. Sustaining technology has to be kept according to agreements with software suppliers. Therefore it makes it difficult to replace sustaining technology with disruptive technology. ORGANISATION C: No preference exists between disruptive technologies or sustaining technologies. A business case will be completed which will discuss the results of the investigation and evaluation of a new technology.
18	Has it happened that customers have been retained because of	ORGANISATION A: Organisation A provides services to municipalities by providing payment

	implementing new innovative technology? Provide a description if applicable.	kiosks inside the municipality building where people can pay utility accounts. Advantages of this solution are that the municipalities do not have to handle cash, fewer cashiers are required and ratepayers can complete their transactions 24 hours per day 7 days a week, municipalities do not have to transport money and the chance of being robbed is reduced. Organisation A has retained the municipalities as a customer. ORGANISATION B: Organisation B was the first bank to introduce the cash box in the market. The customer cashes up at the end of the day and by using the cash box technology, the transaction is updated on the bank system as soon as the customer cashes up. Organisation B has nearly lost customers because of problems of the new technology, but further enhancement to the technology ensured Organisation B retained their customers. Organisation B provides a “Drive-Through-Banking” in areas such as Lesotho and Swaziland, where the driver of a vehicle can drive into a banking facility, which is a secured area, and complete a banking

		transaction. ORGANISATION C: The Speed-Point technology is an example where corporate customers were retained, because of the exceptional functionality of the technology. Customers could not get the technology from any other business, thus the customers were retained.
19	Has it happened that the company has lost customers because of the implementation of new innovative or disruptive technology?	ORGANISATION A: Organisation A could lose customers based on bad services or a bad branch manager, but the bank has not lost customers because of disruptive or innovative technologies. ORGANISATION B: Yes, however, Organisation B enhanced the technology and the customer was retained. Internet banking services were not always successful because customers do not always get statements according to requirements. ORGANISATION C:

		The interviewee is under the impression that customers have not been lost because of using disruptive technology. There are a number of ways that customers can use for their banking services.
20	Does your company use the S-Curve concept when researching disruptive technology or sustaining technology? Describe your answer?	ORGANISATION A: Organisation A does not use the S-Curve concept to evaluate disruptive technology because disruptive technology is seen as a high risk. Organisation A would rather use sustaining technology. From the interviewee's viewpoint, it is individuals (mavericks) who will recognise the potential of disruptive technology. ORGANISATION B: The interviewee from Organisation B was not familiar with the S-Curve concept but after explaining the concept a description was provided. Organisation B will evaluate the new technology and use the complete change management process before implementing new technology and discontinuing the older system. ORGANISATION C: The interviewee does not know what the S-curve means and therefore

		does not use the concept.
21	Was disruptive technology introduced to the company by requests from the customers?	ORGANISATION A: Customers will usually come to the bank with a problem and requires a solution from the bank. For example, Organisation A provides an information technology in a disruptive way but ensure bank security and services to the client for the KZN Department of Health. ORGANISATION B: Customers approach the bank occasionally to provide solutions for easier, safer and quicker banking functionalities. The cash box solution was developed to satisfy a need identified by the customer. The corporate client is very demanding and requires new products and solutions for better banking. ORGANISATION C: All ideas for new development will be received from the executive management or from the different service units within the organisation.
22	Has the company experienced real	ORGANISATION A:

	improvement of productivity and performance since disruptive technology has been implemented in the organisation?	Disruptive technologies or disruptive innovative solutions are used outside Organisation A as solutions for Organisation A clients. These solutions provide improvement in performance of the bank. ORGANISATION B: New technology is evaluated and researched before it is rolled-out. During the evaluation process (feasibility study, business case), a motivation providing that the new technology will support or provide an increase in productivity and performance and to keep a competitive advantage or at least retain the customers is required. ORGANISATION C: Wi-fi connectivity enables executive management, who attend meetings on different campuses to roam between these campuses and have access to calendars or systems they need.
23	How does the security on the information system infrastructure ensure that disruptive technology will not influence the current	ORGANISATION A: The change management process ensures the testing and evaluation of technologies before it is implemented. Disruptive technologies or disruptive innovative solutions are used outside Organisation A as

	information infrastructure?	solutions for Organisation A clients. These solutions update Organisation A bank accounts but do not interface directly into the information systems within Organisation A. ORGANISATION B: The security section within Organisation B studies techniques, methods and technologies that could try to access the Organisation B systems. The security section has to ensure that new technologies are secured to prevent hacking into the bank systems. ORGANISATION C: Wi-Fi was a threat in the past, as the security did not make provision for securing systems when accessed by Wi-fi technology. The authentication and encryption functionality had to be upgraded to prevent any Wi-fi access to the systems.
24	Has your company developed information technology environment standards and protocols to ensure quality and	ORGANISATION A: Standards and protocols have been developed for integration and security purposes and to ensure that the change management systems

	standards of information technology hardware and software which will influence the decision to be made on implementing disruptive technologies?	are available. ORGANISATION B: The change management process is based on standards and protocols, which ensures quality hardware and software. Organisation B subscribes to ITEL and ISO to ensure that standards and protocols are upheld. Furthermore, the Capability Maturity Model for Innovation (CMMI) department ensures that the lifecycle of a technology maintains the standard required by the bank. ORGANISATION C: For the network architecture, standards are in place that is adhered to. Each business unit within the organisation manages their own servers and software, therefore these business units have to manage standards and protocols regarding these servers and software applications. All new technology needs to get approval from the architectural board which evaluates all technologies to be implemented in the organisation.
25	Does the company follow an approach or use a business	ORGANISATION A:

	strategy to handle disruptive technology? (IT business unit should continuously be aware of emerging technologies, be aware of the requirements and business needs of the different business units within the company, changes in needs of customers, other business partners and the industry.)	Organisation A does not have a strategy for disruptive technologies. Organisation A has a strategy that supports sustainable and incremental technology development. ORGANISATION B: The information technology strategy indicates the road map for the rest of the bank. Designated employees are tasked to look for new technologies, which will improve banking solutions and which will influence the strategy the bank will follow in future endeavours. ORGANISATION C: No specific strategy is in place to deal with new technology. The organisation has developed a business unit model where each business unit is responsible for their own strategies for innovation and new technologies. The architectural board oversees all implementation of technology and uses standards to guide the different business units to implement technology which will fit into the architectural framework rather than dictating which technologies should be used.

26	What is the involvement of executives and management?	ORGANISATION A: Executive Management supports the concept of disruptive technology. Executive management is still very conservative and would rather continue working with current systems and procedures rather than taking the risk to implement new technologies, that will change procedures. Currently an Innovative Department exists within the bank, however from the interview it is clear that this department is not successful in launching projects. The change management process enforces long evaluating processes that have a negative impact on rapid change of disruptive technologies. The interviewee works in the Public Sector of the bank, which provides innovative services for the public sector. However it is the mavericks, creative thinkers, employees who can think out of the box, that provide ways of using disruptive technology as solutions, which are beneficial to the company. ORGANISATION B: Executives and management have realised that information technology is the core on which the business runs; therefore the quality of the information technology will ensure the competitive advantage of the

		company. The executives and management encourage the information technology department to search for technology that could be used to keep the customer satisfied. Management supports the information technology strategy, because it indicates the approach the bank has to follow to keep a competitive advantage. ORGANISATION C: Executive management dictates the autonomous business model to encourage for instance a common e-mail system (which is not currently the case), but management do not dictate technology.
27	Does the company follow a process when evaluating disruptive technology? The following can be used as examples: Maturity level of the technology in the market; Unreliable vendor products;	ORGANISATION A: The Change Management process within Organisation A encourages red tape and long evaluating process and testing of technology before it can be implemented. The period for this process can span over 3 years. However the interviewee has described projects where disruptive technology or disruptive ways of doing business have been used outside the bank, but only to ensure retaining or gaining customers. During these projects disruptive technology is tested before implemented. Disruptive

	Outcome of implementation is too uncertain; Usability of technology in company.	technologies are also used in combination to other technologies to provide an innovative way of doing business. ORGANISATION B: Organisation B will look at the value of the new technology, will examine possible risks in terms of the new technology, or verify the stability of the product and execute feasibility studies as part of the process when evaluating a new technology. Organisation B uses the change management process to verify the quality of the vendor and to make sure that the outcome of implementing the new technology will be positive. ORGANISATION C: No formal process of evaluating new technology is in place at Organisation C. Each business unit will use its evaluating process. Usually a business case will be put together and will be discussed at the architectural board.
28	Describe a scenario during which disruptive technology was	ORGANISATION A: The project for the KZN Department of Health is an example where a

	integrated with sustaining technology or implemented to be used in combination with sustaining technology?	payment solution has been developed which interacts with the current applicable Organisation A system. ORGANISATION B: The new technology has to integrate with sustaining technology. If a new technology is not compatible with sustaining technology, the new technology will not be implemented. ORGANISATION C: Internet Banking is an example where the front end was on a Microsoft web platform, which integrated with the organisations' old IBM mainframe back end. The way the integration was done was disruptive and a breakthrough for integration between mainframe and Microsoft web platform.
29	What is the humanistic approach during the consideration and/or implementation of disruptive technology? (Change management; feasibility	ORGANISATION A: The bank has to seek a solution that will provide functionality to be used by the community, which includes the individual and the public sector. These solutions must be beneficial to the customer; the customer must be comfortable to use the solutions. The bank looks for solutions that will

	studies to verify if disruptive technology will be suitable for customers.)	secure the safety of its customer in order to retain the customer. ORGANISATION B: Organisation B uses the change management approach when educating and training employees as well as customers to use technology for better, faster and more reliable banking solutions. Organisation B follows a humanistic approach to make sure that employees and customers can use the systems. The following approaches are followed: Organisation B provides “Help” services on the Internet Banking functionality; Radio and television advertisements are used to announce new products implemented by the bank. Simplifying credit services to all people in South Africa by providing services in 11 languages of South Africa. Organisation B will outsource training of using bank services in rural areas, to ensure that each person that needs to use the ATM

		(Automated Teller Machine) will learn and know how to use the ATM. ORGANISATION C: Organisation C will identify a market sector (e.g. teenagers) and develop products and services targeted at this group (e.g. Cell phone banking). Organisation C will identify websites for example Facebook, and advertise products and services to a specific age group. For rural areas, Organisation C provides caravan-banks, which brought the bank to people in rural areas to make banking accessible. Caravan-banks make use of satellite technology to communicate with bank systems. Cell phone banking is a technology that can also be used by people in rural areas.