

**THE IMPLEMENTATION OF  
INFORMATION STRATEGIES TO  
SUPPORT SUSTAINABLE  
PROCUREMENT**

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## ABSTRACT

In our research context, sustainable procurement can be seen as a process to reduce damage to the environment by integrating certain aspects into making procurement decisions, such as value for money throughout the whole life cycle and being of benefit to society and the economy. This research has found more than one way of interpreting the ‘sustainable system’, for example, ‘green-friendly’ versus remaining effective in the long term. Sustainable procurement requires specific information to support the procurement process. The study reported in this thesis aimed to investigate the type of information needed in order for organisations to make correct sustainable procurement decisions. From these findings, information architecture for sustainable procurement in UK universities has been derived. While the initial focus has been on the information needed to make informed decisions in purchasing sustainable information technology (IT) equipment, it is believed that the framework would also be more widely applicable to other types of purchases. To ensure that these findings would support the university aspiration in terms of sustainability practices, a goal-context modelling technique called VMOST/B-SCP was chosen to analyse the sustainable procurement strategy in order to evaluate the alignment of IT strategy and its business strategy. A goal-context model using VMOST/B-SCP was produced to evaluate the procurement strategy, with this validated by procurement staff. This research helps to improve the way that goals and context are identified by integrating another technique, namely, social network analysis (SNA) to produce actor network diagrams. The VMOST/B-SCP technique is transferrable to the mapping of action strategies. The findings from goal-context modelling show that a goal-context model is not static: it changes as external circumstances and organisational priorities change. Most changes to the strategy occurred where external entities on which the change programme depended did not act as planned. The actor networks produced in our version of VMOST/B-SCP can be used to identify such risks. This research was pioneering in its use of VMOST/B-SCP in examining a business change while it was actually taking place rather than after it had been completed (and thus needed to accommodate changes in objectives and strategies). In addition, the research analysed a system with some IT support but where human-operated procedures predominated. The original B-SCP framework used Jackson’s problem frames which focus on possible software components: in our scenario, SNA-inspired actor diagrams were found to be more appropriate.

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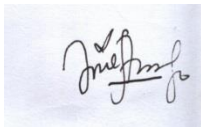
Special dedication goes to my children, Airell, Zara, Mika and Averroes. You keep me going. I hope I have been a good mother and that I have not lost too much during the tenure of my study.

Finally, my thanks go to the rest of my family members and friends for your advice and support throughout my PhD study.

## DECLARATION

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Signed

A handwritten signature in black ink on a light blue background. The signature is cursive and appears to read 'Emelia Akashah Patah Akhir'.

Emelia Akashah Patah Akhir

Dated 21 March 2017

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## LIST OF ABBREVIATIONS

ANSI	American National Standards Institute
B-SCP	framework based on <i>b</i> usiness strategy, context and <i>p</i> rocess
BITC	Business in the Community
BMM	business motivation model
BPM	business process management
BRG	Business Rules Group
CIPS	Chartered Institute of Purchasing and Supply
CSR	corporate social responsibility
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Community (was called European Communities to 1967)
EC	European Council
EMAS	Eco-Management and Audit Scheme
EMS	environmental management system
ENPC	English National Purchasing Consortium
ETAP	Environmental Technology Action Plan
EU	European Union
EuP	Energy Using Products (Directive)
FSC	Forest Stewardship Council
GBS	Government Buying Standards
GDP	gross domestic product
GNP	gross national product
GPA	Agreement on Government Procurement
GPP	green public procurement
HE	higher education
HEFCE	Higher Education Funding Council for England
HP	Hewlett-Packard
ICT	information and communications technology
IPP	integrated product policy
IS	information system/s
ISO	International Organization for Standardization
IT	information technology

ITRAP	IT-related accessories and parts
ITT	invitation to tender
KM	knowledge management
LLP	limited liability partnership
NHS	National Health Service
OECD	Organisation for Economic Co-operation and Development
PC	personal computer
PLC	public limited company
PQQ	pre-qualification questionnaire
RAD	role activity diagram
SC	supply chain
S-E	Seven-Eleven (Japan)
SEDEX	Supplier Ethical Data Exchange
SME	small and medium-sized enterprise
SNA	social network analysis
SP	sustainable procurement
SUPC	Southern Universities Purchasing Consortium
UAB	Universitat Autònoma de Barcelona
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNOPS	United Nations Office for Project Services
UoB	University of Brighton
US/USA	United States/United States of America
V MOST	vision, <i>m</i> ission, <i>o</i> bjectives, strategies and <i>t</i> actics (goal modelling technique)
WLA	whole-life assessment
WLC	whole-life cost/costing
WTO	World Trade Organization

## Chapter 1

### INTRODUCTION

Public procurement of works, goods or services plays a very important role in stimulating innovation and represents 18% of European Union (EU) gross domestic product (GDP) (European Commission, 2014). While it is important to ensure that public money is being spent in such a way that people are able to gain long-term benefits, public organisations should be thinking of the ways in which they can ‘green’ their procurement practices. Integrating sustainability into public procurement could provide so many benefits, included among them minimising damage to the environment, reducing whole-life cost and providing value for money (Williams, Chambers, Hills, & Dowson, 2007). According to New, Green and Morton (2002), some countries have implemented several approaches to green their public procurement, including all 50 states in the United States (USA). However, many countries are still formulating and developing their policies in this area. Section 1.1 broadens the discussion on sustainability. The motivation for this particular research is then explained in Section 1.2. In Section 1.3, the research questions are presented, followed by the research objectives in Section 1.4. The structure of the thesis is outlined in Section 1.5: in Section 1.6, published work arising from this research is highlighted.

#### **1.0 Research Background**

Developing sustainable procurement is one element of a broader sustainable development effort. Brundtland’s definition of sustainable development for the United Nations (Brundtland, 1987) is stated as follows: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to

meet their own needs”. Many definitions of sustainable procurement are available (Young, Nagpal, & Adams, 2015). The Sustainable Procurement Task Force defines sustainable procurement as a

“process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment” (DEFRA [Department for Environment, Food and Rural Affairs], 2006).

Sustainable procurement involves three different aspects: economic, environmental and social. Below are examples of some possible issues in each aspect of sustainability:

1. Economic: local sourcing, suppliers’ reliability, small and medium-sized enterprises (SMEs) (BITC [Business in the Community], 2009)
2. Environmental: carbon emissions, waste disposal, energy efficiency (BITC, 2009)
3. Social: worker exploitation, bribery and corruption, minimum labour standards (Chartered Institute of Purchasing and Supply and Traidcraft Exchange, 2013)

During discussions with key people in sustainability from universities in the United Kingdom (UK), they tended to discuss their procurement practice in terms of the economic and environmental aspects but not the social aspect. The reason these two aspects are at the forefront of sustainable procurement implementation in UK universities is believed to be that the Department for Environment, Food and Rural Affairs (DEFRA) has directed universities to produce a carbon reduction plan:

*... they look at which model: these I took off [Information Technology] IT’s page on the website, which is covering major sustainability issues they’re looking at in terms of IT [information technology] purchasing, a bit on energy usage, video conferencing, consumption, cooling, etc. Packaging is certainly an initiative and*



*I'm pretty sure it comes out from ... framework where they got obligations from suppliers that they will recover their own packaging, minimise the packaging, not [use] bubble wrapping, etc. (Head of Procurement, University of Sussex, February 2014)*

*... We look for sort of [the] minimum requirement; we look for financial stability; a lot of [the] time we're looking for the standard that they have for manufacturers ..., sustainable credentials. (Procurement Manager, University of Reading, personal interview, April 2014)*

*... we asked questions about power usage; it's the main concern from IT because we have thousands of machines so power usage is quite an issue; we are also interested in sort of proposals for disposal of old hardware. (Procurement Manager, University of Bristol, personal interview, August 2014)*

In UK universities, economic and environmental aspects are more easily incorporated into the practice of sustainable procurement compared to the social aspect (Young et al., 2015). For our research context, sustainable procurement is mainly discussed in terms of environmental and economic aspects because the context for this study is procurement in universities. Some familiar terms related to sustainable procurement are 'whole-life cost' and 'value for money'. The term 'whole-life cost' takes into account the costs of using and/or disposing of a product as well as the purchase price. It is closely related to the environmental aspect whereas the term 'value for money' always refers to the economic aspect.

The concept of value for money means that when purchasing any products, one should not only depend on the minimum purchase price but should also take into account how much value or benefit one could receive from them (Australian Government, 2011). This concept could be incorporated into sustainable procurement (Australian Government, 2011) by allocating a certain percentage as a weighting to sustainability credentials during a tender process (Young et al., 2015). A life cycle approach requires purchasers to consider all the costs incurred from the buying cost through to maintenance and disposal costs (Tepper, Hidson, Clement, & Anglada, 2008).

## 1.1 Research Scope

The scope of this research was initially to explore issues relating to carbon emissions reduction in UK higher education (HE). In reference to the definition of sustainable procurement explained in the above section, carbon emissions reduction is one example of ways to minimise damage to the environment. Carbon emissions which cause greenhouse gas effects, that is, extreme weather changes and an increase in the global temperature, can be minimised via effective carbon emissions management. The UK Government signed the Kyoto Protocol in 1995 and has taken a number of steps to limit the UK's carbon emissions (Committee on Climate Change, 2008). Subsequently, the scope of the current study widened as many sustainability criteria other than carbon emissions reduction needed to be taken into account, such as recycling, waste disposal, water consumption, value for money, etc. Universities and colleges, among other public organisations, could help the UK Government to reduce the environmental impact via sustainable procurement with steps such as buying IT equipment with low energy consumption (James & Hopkinson, 2009). However, for public organisations to start to procure sustainably, sustainable procurement policies must be in place based on reliable information.

A good procurement practice could help in improving environmental performance (UNEP [United Nations Environment Programme], 2012). When decisions to procure are made by taking the environmental impact into account, environmental issues could be reduced. For example, to reduce energy usage, one could purchase an ENERGY STAR<sup>®</sup> 4.0-compliant computer (James & Hopkinson, 2009). The public organisations that need to embrace sustainable practices include higher education institutions, and the central UK Government has taken steps to ensure that this happens. In 2011, the Higher Education Funding Council for England (HEFCE) announced that all higher education (HE) in England must have a carbon management plan because the awarding of HEFCE's

capital allocations (Higher Education Funding Council for England [HEFCE], 2010b) is now predicated on having an approved carbon management plan.

Public procurement in the UK implements EU directives (Office of Government Commerce, 2008); therefore, framework agreements established by buying consortia must be compliant with EU public procurement regulations (HM [Her Majesty's] Treasury, 2009). However, as we are aware, the vote for Brexit took place in 2016 and, as far as this is concerned, this research will not be affected by the UK exit from the European Union (EU). Changes in procurement will possibly happen but these are currently unclear (Heywood, n.d.).

By negotiating collectively with suppliers (through a consortium) to sign up to a framework agreement, universities can buy discounted products from suppliers. A wide range of products and services are listed in framework agreements, from IT to business travel, etc. Although the available framework agreements covered a wide range of products, we narrowed the scope to only IT products.

## **1.2 Motivation of Research**

Developments in IT/information systems (IS) that could facilitate sustainable procurement are very much needed by universities to meet their aspiration to become sustainable. The types of information needed to purchase sustainably consist of different criteria, such as usage of electricity and source of the products. These product criteria come from different sources; for example, usage of electricity may come from the ENERGY STAR<sup>®</sup> website while the source of products may come from the product manufacturer. Therefore, to consider buying sustainable products, many sorts of criteria need to be looked at, with all of these criteria not coming from a single source. Some information is from the internet, while other information could be in the form of documents or government directives. A large amount of information is involved in

making sustainable procurement decisions. Access to this amount of information, which comes in different formats, can be done only via external information architecture for many reasons. Obviously, the main reason is the complexity involved in building an internal database to hold all of the information needed. Thus, information architecture is needed to allow access to information from many different external sources.

### **1.3 Research Questions**

**RQ1:** What would be the appropriate type of information and processes needed to support the sustainable procurement of goods and services by public sector organisations?

**RQ1.1:** What does ‘sustainable procurement’ mean in the context of UK universities?

**RQ1.2:** What are the typical current practices in sustainable procurement?

**RQ1.3:** What is recognised best practice in sustainable procurement?

**RQ2:** What are the ways to assess the alignment between the change programme and organisational goals?

### **1.4 Research Objectives**

This research aims to:

- i. Identify the type of information and processes needed in order to make informed decisions on sustainable procurement in the public sector, specifically in a higher education institution.

- ii. Investigate the alignment between the change programme and organisational goals by applying the VMOST/B-SCP technique to create a goal model.

## **1.5 Structure of Thesis**

This section provides a brief outline of each of the remaining six chapters of this thesis.

### **Chapter 2: Literature Review**

This chapter discusses related works regarding sustainable development as a whole with the focus on sustainable procurement in UK universities. The chapter also presents best practices on sustainable procurement. In addition, it discusses the EU and UK legislation regarding sustainable procurement and how the legislation affects the process of sustainable procurement in the UK. Some background is provided on knowledge management and information architecture. In the study, we sought to explore the relationship between knowledge management and information architecture and how they could be integrated with sustainable procurement, with this described in Chapter 2. Furthermore, we describe the approach used to evaluate the alignment of the organisation's business aspirations and its implemented actions using the VMOST/B-SCP framework. A general review of recent academic research into sustainable procurement is also included.

### **Chapter 3: Research Methodology**

This chapter discusses the research methods used. The case study method used in this research is presented, in which exploratory interviews were conducted at one UK university. In addition, the chapter involves discussion of the approaches used to identify key stakeholders or players in sustainable procurement in universities. The discussion then covers another round of

interviews that were conducted involving a number of UK universities and also purchasing consortia. As one of the methods used to collect data for this research was contextual information, this is also discussed. The social network analysis (SNA) approach was then used to identify stakeholders in each institution to find the commonality across institutions in sustainable procurement practice.

The selected data analysis method is explained in this chapter, with the study using NVivo software to analyse interview transcripts. This chapter later discusses the application of VMOST and the B-SCP framework to construct a goal model.

#### **Chapter 4: Case Study: University of Brighton**

This chapter discusses the research's results and findings on the sustainable procurement practices of our case study, the University of Brighton (UoB). The findings are in the form of a role activity diagram and information model of the current procurement process, and the SNA diagram of the university's procurement network.

#### **Chapter 5: UK Universities**

Chapter 5 presents the research's results and findings on sustainable procurement practices in UK universities. The process of interview design and analysis, and the SNA diagram for UK universities are discussed. Validation of the role activity diagram and information model are also presented in this chapter.

#### **Chapter 6: Procurement Strategic Initiative at University of Brighton**

This chapter discusses the goal model and its implications for assessing the change of sustainable practices in procurement. Any misalignment between

university aspirations and the actual implementation of sustainable procurement is discussed.

## **Chapter 7: Conclusions and Future Research**

The overview of the whole research work and the results are presented in this chapter. The thesis concludes with a summary of the research contributions and suggests potential work for future research.

### **1.6 Published Work**

This research has been presented and/or published in conference proceedings as follows:

- Doctoral Consortium, Worcester College, University of Oxford, Oxford, UK, 18-20 March 2013
- Brighton Doctoral Conference, University of Brighton, July 2013
- Research Poster Competition, Doctoral College, University of Brighton 2013
- **Akhir, E. A. P.**, Hughes, R. T., & Cox, K. (2014). The Implementation of Knowledge Management in Sustainable Procurement Using Social Network Analysis. In *European Conference on Social Media*, Brighton (pp. 721), 10-11 July.
- Hughes, R. T., Cox, K., & **Akhir, E. P.** (2014). An information infrastructure for sustainable IT procurement: a suitable case for Actor-Network Theory? In *Proceedings of UK Academy for Information Systems (UKAIS)*. Oxford, UK: UKAIS.
- Hughes, R. T., Cox, K., & **Akhir, E. P.** (2016). Modelling the alignment of information systems and business strategy: an example from sustainable procurement. In *24th International Software Quality Management (SQM) and INSPIRE Conference*. Bournemouth: SQM/INSPIRE.

## LITERATURE REVIEW

### 2.0 Chapter Introduction

Sustainable practices need to be implemented to increase the awareness of people in the industries that are dealing with environmental issues (Zailani, Jeyaraman, Vengadasan, & Premkumar, 2012). Many organisations today have realised the importance of integrating traditional supply chains with sustainability practices as resource availability decreases while world population increases (Carter & Jennings, 2002). To address this matter, the concept of sustainable or green supply chains has been introduced. Through this concept, sustainability is integrated within supply chains to ensure that any harmful impacts by supply chains on the environment are reduced.

To understand issues relating to sustainability, some familiarity with the organisational and industrial contexts is needed, which this chapter provides. One focus of the discussion is on the law and regulations relating to sustainable development, with particular reference to the EU (European Union). The EU objectives in supporting sustainable development present a starting point. This chapter provides some background information about these objectives, concentrating on sustainable procurement and its impact on the UK as one of the EU's member states.

This chapter discusses public procurement in relation to sustainability and considers how these two elements could be integrated to produce sustainable procurement. We then look at integrating sustainable procurement with knowledge management.

Section 2.1 discusses public procurement in the EU and the UK. Section 2.1.1 explains EU procurement policy and how it affects UK public procurement. The following section discusses UK legislation on public procurement in general terms. The



next sections, Sections 2.1.2.1 and 2.1.2.2, discuss some public procurement rules set up by the UK Government.

Section 2.1.4 moves the focus to ‘green’ public procurement. More specifically, in Section 2.2, the application of knowledge management to sustainability practice is discussed. A brief introduction to knowledge management is presented in Section 2.2.1, with how it can be applied to sustainable procurement explained in Section 2.2.2. Information architecture is discussed in Section 2.2.3. The relationship between knowledge management and information architecture is explored in Section 2.2.4. The concept of sustainable/green supply chains is explained, leading to an explanation of sustainable procurement in Section 2.3. Section 2.4 explains how sustainable procurement requires the criteria that make products ‘sustainable’ to be identified. As accreditation bodies are often used to assess and verify that products meet sustainable criteria, this is explored in Section 2.6. Sustainable procurement in higher education is discussed in Section 2.7, with Section 2.8 summarising the chapter.

In this research, we explored public organisations and their procurement practices. The following section discusses procurement practice in the public sector.

## **2.1 Public Procurement**

Public procurement, one of the main functions within a government (Thai, 2001), acquires goods and services for public sector organisations (Uyarra & Flanagan, 2009). According to Arrowsmith, Faustino, Heuninckx, Treumer and Fejø, (2011, p. 215), public sector bodies wishing to acquire goods or services tend to award contracts to framework suppliers if possible. Effectively managed procurement is essential to make available the necessary goods and services that provide value for money for taxpayers (Office of Government Commerce, 2008).

As the government has ultimate control over the public sector, all public organisations are under greater or lesser pressure to follow government policies. In the UK, public sector procurement is governed by UK law and legislation which are, in turn, shaped by EU directives, as the UK is an EU member state. Directives from the EU for sustainable development are next discussed to examine how they impact on governments in the EU, including the UK in particular.

### **2.1.1 EU directives**

As the United Kingdom (UK) became part of the European Community (EC) in 1973, all EU directives, including those related to public procurement, have to be incorporated into UK law. All public bodies in the UK can be affected by EU directives. When a contract is to be awarded, if the contract value is above a certain threshold, the procurement process must be done in accordance with EU regulations (Arrowsmith et al., 2011).

In addition to the EU requirements for trade within the EC, the World Trade Organization (WTO), of which the EU is a member, promotes similar free trade rules to a broader group of countries.

According to Ashurst Limited Liability Partnership (LLP) (2012), several international elements are incorporated in EU public procurement law. For example, the WTO Agreement on Government Procurement (GPA) involves a plurilateral treaty among its members, meaning that not all WTO members are bound by it (European Commission, 1994). This agreement was originally signed in 1994 by 15 countries. In 2016, this became 47 countries, as stated on the WTO website (<http://www.wto.org>) (Perera, Morton, & Perfremment, 2009), including Armenia, Canada, European Union (EU), Hong Kong, Iceland, Israel, Japan, South Korea, Liechtenstein, the Netherlands (with respect to Aruba), Norway,

Singapore, Switzerland, Chinese Taipei and the United States (US). With the GPA, trade between member states has to be 100% transparent with equal treatment for all potential suppliers. For example, when a company in the UK is choosing its suppliers, it has to consider all qualified suppliers from the UK and other member states. Foreign products cannot be discriminated against but need to be treated equally (Ashurst LLP, 2012, p. 3). The EU view (European Commission, 1994) is that the main objectives of such negotiations are:

- a. Transparency in international public procurement.
- b. The WTO GPA to ensure transparency rules are really implemented in public procurement.
- c. International market access: each member offers procurement access to industry in their country. For example, Canada offers procurement access with its provinces, while South Korea provides procurement access to its railway and transport industries.
- d. Access to the WTO GPA by developing countries.

The overarching EU goal is to create a common European market where buyers and sellers can trade within any member state. As we have seen, the EU public sector procurement policy is implemented through EU procurement directives (Arrowsmith et al., 2011). The aim is to ensure the entire purchasing strategy of each EU government is completely transparent. A government cannot be seen to favour one national group within Europe. Two public procurement directives, adopted in 2004 by the Council of the European Union and the European Parliament with the objectives of clarifying, simplifying and modernising the existing European legislation on public procurement, have been implemented into the national law of each of the EU member states:

- i) Public Sector Directive 2004/18/EC – this regulates the procedures related to major public sector contracts (European Parliament and the Council, 2004b).
- ii) Utilities Directive 2004/17/EC – this regulates the procedures related to utilities: the water, energy, transport and postal services sectors (European Parliament and the Council, 2004a).

The two directives mentioned above are, in general, concerned with government procurement policies, with a focus on fair competition between suppliers. The EU's policy in relation to sustainable procurement needs to be seen in the context of this broader competition policy.

The European Council (EC) endorsed an EU Strategy for Sustainable Development (European Commission, 2001a) in June 2001 and agreed that this policy was meant to reduce the use of resources, with a focus on the implementation of measures reducing the environmental impact of waste (European Commission, 2001b). A Green Paper on Integrated Product Policy (IPP) (European Commission, 2001c) was produced which proposed a strategy to promote green products, for example, by focusing on eco-design of products. Later, in June 2003, the European Council (EC) published a Communication on Integrated Product Policy (IPP) (European Commission, 2003). In 2008, proposals on sustainable consumption and production were presented (European Commission, 2008a) which aimed to reduce the environmental impact of significant products by improving their energy and environmental performance by standard setting throughout the internal market. According to Mudgal (2008), the IPP can be linked to a number of other EU policies, namely, the Eco-Management and Audit Scheme (EMAS), the EU Eco-label Scheme, the Environmental Technology Action Plan (ETAP) and Green Public Procurement (GPP). Other

policies comprise the Eco-design of Energy Using Products (EuP) Directive; European Compliance Assistance Programme: Environment & Small and Medium Enterprises (SMEs); Thematic Strategy on Sustainable Use of Natural Resources; and Thematic Strategy on Waste Prevention and Recycling.

In 2014, new procurement directives (2014/24/EU) were introduced. According to the 2014 Directive on Procurement, environmental criteria can be applied in the pre-procurement process and also in procurement contracts by public authorities as part of the procurement process (European Commission, 2016a).

The next section discusses UK legislation, which is important in order to see the implications of EU legislation for UK procurement law.

### **2.1.2 UK legislation**

As can be seen, social and environmental objectives have become one of the concerns of public procurement law. The decision to procure services or other supplies must be taken in the light of environmental objectives such as carbon emissions reduction (Arrowsmith et al., 2011). The UK, as one of the EU member states, has implemented the EU directives in its public procurement laws. The following two sets of UK Regulations relate to procurement in England, Wales and Northern Ireland) (Ashurst LLP, 2012):

- Public Contracts Regulations 2006 (revised 2015) implement the EU rules relating to services, supplies or works procurements entered into by public bodies other than utilities (the Public Contracts Regulations); and

- Utilities Contracts Regulations 2006 (revised 2016) implement the EU rules relating to services, supplies or works procurements entered into by utilities (the Utilities Contracts Regulations).

To comply with EU requirements, the UK Government has restated its public procurement law so that it is compatible with the EU directives on public procurement. Below are some of the rules laid down by the UK Government as mandatory in public sector organisations.

#### **2.1.2.1 Transparency rules**

The UK Government has set up new transparency rules to be implemented across all government departments. According to Ashurst LLP (2012), the following requirements also apply to all public bodies, including central government departments, National Health Service (NHS) trusts, trading funds and all non-departmental public bodies:

- all new central government information and communications technology (ICT) contracts must be published online;
- all new central government tender documents for contracts over £10,000 must be published on a single website made available to the public free of charge; and
- all new central government contracts must be published in full.

To ensure that these rules are properly implemented, the Contracts Finder website (see <https://www.gov.uk/contracts-finder>) was launched as a platform for providing and sharing public sector procurement-related information (Ashurst LLP, 2012).

### **2.1.2.2 Selection of candidate suppliers**

It is probably easier to assess a supplier than a whole supply chain. The public procurement directives set out rules relating to the selection of candidate suppliers capable of satisfying the requirements of a particular contract. The suppliers need to:

- have specific relevant environmental experience, especially for those contracts that require environmental know-how in the field (e.g. construction of a waste treatment plant)
- operate an environmental management scheme that has been set up according to international standard ISO 14001 (refer Section 2.1.3; European Commission, 2001).

Even though suppliers are ISO 14001-certified, this does not mean that their goods and services are guaranteed to meet existing sustainability requirements. The certification indicates that the supplier has a management system that sets and monitors its environmental standards (Chen, 2005). Other standards in the ISO 14000 group of standards deal with eco-design (ISO 14006) and eco labels (ISO 14020) which are explained in detail below.

The new public procurement directives introduced by the EU in 2014 improved the rules to be considered in selecting suppliers. In following the rules, contracting authorities may require information, such as product certification; and social aspects can be taken into account as well as factors related to the production process (UK Crown Commercial Service, 2016).

The next section discusses the ISO standard that relates to our research domain.

### 2.1.3 International Organization for Standardization (ISO) standards

This section presents the explanation of the related International Organization for Standardization (ISO) standards that are relevant to sustainable procurement as shown in Table 2.1. Explanations are provided on other standards that could support sustainable procurement by organisations.

*Table 2.1: ISO standards related to sustainable procurement*

<b>Accreditation type</b>	<b>Description</b>
ISO 14001	Provides guidance to organisations to make their daily operations more sustainable. It also helps organisations to protect the environment by specifying requirements for an effective environmental management system (EMS) (Certification Europe, 2012).
ISO 20400	This is currently a draft ISO standard. It provides guidelines for organisations who would like to integrate sustainability into their procurement processes. It also assists in the development and implementation of responsible sourcing (Willaert, 2016).
ISO 14006	Provides guidelines for organisations to improve their management of eco-design as part of an EMS (International Organization for Standardization, 2011).
ISO 14020	Provides guidelines for organisations to develop and use environmental labels and declarations (International Organization for Standardization, n.d.).

The next section discusses in more detail one of the EU policies linked to IPP, namely, green public procurement (GPP). This policy is the most relevant to our research domain.

### 2.1.4 Green public procurement (GPP) in the EU

The introduction of environmental requirements in public procurement in EU member states, whereby common criteria exist for certain listed products, has been designed to ensure a uniform procurement process across organisations. According to the European Commission (2001b), green public procurement (GPP) is defined as:



“... a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.”

Green public procurement (GPP) was first proposed in an EU Commission Communication to the European Council and the European Parliament in 2003 (European Commission, 2003). However, it was found during the early stages of the introduction of GPP that public authorities were not really sure of the best method of implementing GPP (European Commission, 2008b). Therefore, in 2008, the EU proposed the production of a GPP management model to support the more effective and systematic implementation of GPP (European Commission, 2008c). In the Commission Communication, member states were encouraged to develop their own three-year National Action Plans which were to include a plan to be adopted for greening the procurement process, an assessment of the current situation and targets along with measures to achieve over the next three years. A new European legal framework for public procurement clarified how public purchasers could include environmental considerations in their procurement processes and procedures.

The EU encouraged all of its member states, including the UK, to adopt GPP in their procurement policy. The GPP criteria were introduced in the UK through the Government Buying Standards (GBS) (DEFRA, 2012) which were designed to help buyers to procure sustainably. The GBS provide an official specification that buyers across the public sector must follow when purchasing a range of products. All central government departments and their related organisations must at least meet the minimum mandatory specifications to purchase products. According to DEFRA (2013), around 50 standards are grouped into 10 priority

product groups. The enforcement of the GBS by public sector organisations has meant that suppliers need to prove that they are compliant with these standards, thus creating competition among suppliers to develop products that satisfy the requirement to reduce environmental impact.

A similarity is evident between the GPP criteria and the GBS, as the GBS are a development that has arisen from green public procurement (GPP). However, GPP was for EU member states while the GBS are mandatory for all UK government departments and their related organisations. All member states of the EU have agreed to the GPP proposal that:

“... 50% of all tendering procedures should be green, where “green” means “compliant with endorsed common “core” GPP criteria ... The percentage would be expressed in both number and value of green contracts as compared to the overall number and value of contracts concluded in the sectors for which common “core” GPP criteria have been identified” (European Commission, 2008a).

Both the GPP and GBS criteria are set at two main levels, with the first level known as core/mandatory which shows that the target has to be achieved now while the second level is comprehensive/best practice which shows the target should be achieved in the future. The GBS follow GPP in having 10 priority product groups. The 10 product groups are:

- a) Cleaning products
- b) Construction
- c) Electricity/electrical goods/energy-using products
- d) Furniture
- e) Food
- f) Gardening services
- g) Office ICT equipment
- h) Paper
- i) Textiles

## j) Transport

As will be discussed shortly, our initial focus has been on the procurement of electrical goods and office IT equipment. The GBS focus on particular criteria:

- energy in use
- water in use
- end-of-life costs:
  - reparability
  - upgradeability
  - recyclability
  - hazardousness of materials used
- resource efficiency: quantities of scarce materials used and recycled content.

### **2.1.5 Sustainability criteria for office IT equipment**

Among the common key sustainability criteria for IT equipment are energy efficiency, whole life cycle costs and compatibility of software with its hardware. However, it is also important to assess the components and materials used to produce IT equipment. In addition, IT equipment should be easy to dispose of at the end of its lifetime, have certain components that are easy to replace and upgrade if necessary, and must be energy efficient (DEFRA, 2014).

The Department for Environment, Food and Rural Affairs (DEFRA) has published its Official Government Buying Standards (GBS) as a buyers' guide for computers, printers, scanners and workstations. The process of integrating sustainability into procurement is still in the initial phase. Thus, the importance of sharing new information and knowledge about this area is very useful in making sustainable procurement successful. Therefore, we proposed that knowledge management be introduced into procurement networks.

## **2.2 Knowledge Management**

The problems with effective sustainability-led procurement can be seen as related to the management of knowledge about sustainability criteria which include product and supplier characteristics. With sustainable procurement, a wider range of knowledge needs to be considered to support purchasing decisions.

Section 2.2.1 describes knowledge management (KM) and its importance in general terms in applying this concept in organisations. In Section 2.2.2, the discussion of knowledge management looks at the particular advantages of its implementation in the context of sustainable procurement.

### **2.2.1 Knowledge management definition and activities**

Knowledge management can be defined as

“... a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers” (Duhon, 1998).

Davenport and Prusak (1998) stated that it is important to manage organisational knowledge in order to make the most of it and to gain as much value as possible. To really understand the definition of knowledge, one should understand the difference between data, information and knowledge. These three are interrelated. Data are symbols that represent objects. However, when data are processed and presented in tabular form and are able to answer ‘who’, ‘what’, ‘how many’, ‘when’ and ‘where’, it is known as information. Knowledge, on the other hand, should be able to answer ‘how to’ questions (Ackoff, 1989). For example, with a laptop specification as information, one can make a decision on which laptop to

choose based on it having less impact on the environment, with this based on best practice.

The five activities in knowledge management are: knowledge acquisition, knowledge documentation, knowledge transfer, knowledge creation and knowledge application (Filius, de Jong, & Roelofs, 2000). Knowledge acquisition refers to the situation when an organisation is able to obtain knowledge from its suppliers, customers, competitors, partners, etc. Once knowledge is obtained, it is worth documenting and storing it in a place, such as an online database, where everybody can easily access it. As sustainable procurement in UK universities is still new, one application of KM would be meeting the need for a proper guideline for procurement teams and others to make informed decisions.

Most of the organisation knowledge on sustainable procurement relates to things external to the organisation, such as information about products and suppliers. Information would need to be imported, rather than being held in some unwieldy internal database. Hence, rather than a database, the concept would be of a widely accessible information infrastructure to organise access to all the information related to selection criteria and whole life cycle assessments, accreditation bodies and their standards, available sustainable products, and suppliers and their supply chains. This would facilitate the sharing of knowledge of external organisations and people in inter-organisational networks. The architecture of this information infrastructure for supporting sustainable procurement processes can be consciously designed and implemented over time. Hanseth and Monteiro (1998), in their paper, stated that one aspect of information infrastructure is that it is designed not only to support specific applications but also various activities. They added that it seems to suit sustainable procurement processes which require different activities, for example, the establishment of a

framework agreement, suppliers' evaluation and product selection in order to make informed sustainable decisions. This could help the organisation to share the costs and risks of their business between more organisations. By doing so, it is possible that new knowledge would help the organisations to reduce the associated risks, as sustainable procurement decision makers need to know they can trust the information they access (Ramasamy, Goh, & Yeung, 2006). When knowledge is obtained, and shared with others, the possibility of disseminating new knowledge is high as this is normally based on the existing knowledge in the network. When everything is in place (existing knowledge, new knowledge and the knowledge base), knowledge is now ready to be applied to any project or process in the organisations.

### **2.2.2 Knowledge management in the context of sustainable procurement**

Sustainable procurement (SP) can be considered as a new approach to procurement owing to its concern for environmental, social and economic issues relating to procurement activity (Adjei, 2010). Our initial survey of the literature has shown that buyers need a much wider range of information to guide them in purchasing sustainable products. Haythornthwaite (1996) identified the resources transferred along the line as either tangible products (money, goods, etc.) or intangible products (information, influence, etc.). In our research, we were concerned about both information and products as the types of resources being transferred. Some research has concentrated on knowledge and/or information seeking a type of resources exchange, for example, Cross, Borgatti and Parker (2001); Fazey et al. (2013); and Haythornthwaite (1996). This situation can be linked to the context of our research. For example, buyers who are interested to buying sustainable IT products may not have relevant knowledge and find it

useful to access accurate and up-to-date information, for example, about energy consumption from other parties. Having information available which helps buyers in making decisions without doubt improves the buying experience according to Huang, Lau and Mak (2003). The necessary information includes the selection criteria of products and suppliers. If inaccurate or incomplete information is being shared, then this is very dangerous and can lead to inefficient processes in organisations (Larson, 1994).

Sustainable procurement is an example where some business goals are difficult to achieve by one organisation alone, so inter-organisational relationships are important to help in their accomplishment. This needs mutual trust. To encourage trust, exchanges of information should be in both directions and any benefits should be shared (Cheng, 2011). To relate this to our research, trust is important in sustainable procurement as buyers need information provided by other parties, such as suppliers, accreditation bodies, universities' buying consortia and others, in order to make informed decisions. Information that is being transferred or exchanged includes sustainable criteria for IT products, details of sustainable suppliers and their supply chains, product certification and framework agreements by purchasing consortia and suppliers. These types of information are then composed into an information infrastructure to support the information exchange in order to expedite the procurement process and facilitate the choice of the most sustainable products by decision makers. Moreover, this provides better access to information or knowledge about best practice.

### **2.2.3 Information architecture**

Information architecture is an approach that classifies and organises large amounts of information so that it is more accessible and the right information is easier to find (Monteiro & Hanseth, 1996). Information is defined as data that are contextualised, categorised, calculated, corrected and condensed (Davenport & Prusak, 1998), for example, supplier backgrounds. On the other hand, knowledge is derived from information with implied know-how and understanding (Davenport & Prusak, 1998), for example, the selection of sustainable suppliers from a pool of suppliers list. It is important to make sure information is accessible because the information will create knowledge (Taljaard, 2007). In this research, information comes from both internal and external organisations. Large amounts of information need to be efficiently accessed in order to make decisions about sustainable procurement. Information from suppliers, buyers, accreditation bodies and others needs to be linked and structured so no information is missing or overlooked when making procurement decisions.

### **2.2.4 Relationship between knowledge management and information architecture**

According to Taljaard (2007), the relationship between knowledge management and information architecture is based on the ability of information architecture to improve the retrieval of explicit knowledge. Information architecture provides better access to the relevant information or knowledge that is critical in the process of decision making. Taljaard also mentioned in her dissertation that information architecture enables better access to less tangible knowledge by “creating logical referents to the embodiments of such knowledge (i.e. the people with the



knowledge, know-how, etc.) in electronic systems such as intranets, etc.”  
(Taljaard, 2007, p. 97).

### **2.3 Sustainable/Green Supply Chain**

In the previous section, the issue of accessing information and knowledge to identify sustainable products was addressed. This centred on the assessment of the quality attributes of a product to be bought. What this does not take into account is the impact on the environment of the methods by which the product was created, including the well-being of people involved in the creation of the product. One aspect of this concern for the process is that many organisations are trying to transform their supply chains (SCs) into ‘green’ or ‘sustainable’ supply chains. One definition of a supply chain is “a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer” (Mentzer et al., 2001). ‘Greening’ the commercial supply chain could involve everyone from retailing and manufacturing firms to their suppliers/subcontractors through to raw materials extractors (Sarkis, Zhu, & Lai, 2011).

Some of the most important interfaces in a supply chain are the purchasing functions in organisations and these are essential in helping organisations to achieve their sustainable development objectives (Walker & Brammer, 2009). A sustainable/ green procurement process would need to incorporate environmental awareness of the nature of the supply chain that provides the purchased products. When first introduced, the main environmental concern of the sustainable supply chain was to reduce waste for economic reasons, and not for environmental reasons (Sarkis et al., 2011), such as using materials which did not harm the environment. Since then, broader concerns have developed,

particularly within public sector bodies (Walker & Brammer, 2009), such as adding more criteria to be considered before buying a product.

Table 2.2 below reviews various types of issues that arise in relation to the three categories of sustainability: environmental, economic and social.

*Table 2.2: Examples of sustainability issues*

<b>Categories</b>	<b>Issues</b>	<b>Author(s), Year</b>
Environmental	Waste	(Mazzanti & Zoboli, 2008; Lamming & Hampson, 1996)
	Carbon emissions	(Chang, 2013; Omer, 2008)
	Water consumption	(Omer, 2008)
	Whole life cycle	(Lamming & Hampson, 1996)
	Recycling	(Sinha-Khetriwal, Kraeuchi, & Schwaninger, 2005)
Economic	Value for money	(Adjei, 2010)
	Support local business, SMEs	(Adjei, 2010)
Social	Child labour	(Alder & Gooch, 2013)
	Minimum wage	(Alder & Gooch, 2013)
	Ethics	(Beamon, 2005)
	Anti-discrimination	(McCrudden, 2004)
	Corporate social responsibility (CSR)	(Zink, 2005)

Information on sustainable product criteria is available from many sources. This information can be used as a guideline in choosing the most sustainable products to purchase (DEFRA, 2012; Environmental Association for Universities and Colleges, 2011; UNEP, 2012).

Cheng, Yeh and Tu (2008) stated that, to ensure that this initiative is successfully implemented, knowledge sharing among individuals and organisations in a supply chain is a must. Knowledge management is needed to enable knowledge sharing; thus, it should be practised within organisations. For example, purchasers should request information about products from their suppliers, such as the source of the goods that are acquired. Knowledge also needs to be shared within the business/organisation itself (Inkpen, 2000).

For example, employees across the organisation can share their opinions about the qualities of different suppliers. Another way that knowledge could be shared is between organisations that buy similar products from the same group of suppliers. Effective knowledge sharing applied to the whole supply chain could contribute to successful implementation of sustainable/green procurement (Wu, Cheng, & Huang, 2010). However, resistance will be encountered with regard to information sharing. For example, letting a customer know how much profit an organisation makes when the supplier supplies them with a product could encourage the supplier to try to drive down the price. Information about the identity of one's suppliers might enable customers to deal with them directly. Many other barriers have made people unwilling to share their knowledge, mostly due to their culture. However, this culture of feeling insecure when sharing information can be addressed by implementing initiatives to make sharing knowledge important, for example, indicating that sharing knowledge can solve practical problems of the organisation (McDermott & Dell, 2001).

For the successful implementation of sustainable procurement, green manufacturing firms should, where appropriate, provide training and sharing of their green knowledge to their supply chain partners (Cheng et al., 2008). Organisations often have a limited idea of the practice and implementation of green practices due to a lack of available information (Wilkerson, 2005). Thus, it is imperative to ensure that the knowledge in the procurement network is transferred from one person to another for the benefit of the whole organisation (Wu et al., 2010). Many types of information are necessary for buyers to consider: with a supply chain, one should have some information on the risk analysis for the supply chain.

The sections below discuss sustainable procurement in more detail as one aspect of the green supply chain and how it can be used to encourage the implementation of the green supply chain especially by public bodies.

### **2.3.1 Sustainable procurement**

The UK Government Sustainable Development Strategy (DEFRA, 2005) suggested the integration of sustainability assessments into “spending and investment decisions”. Sustainable procurement can be seen as a subset of green supply chain management (Bai & Sarkis, 2010). An evolution has occurred from an initial organisational concern to reduce waste into green/sustainable purchasing which incorporates broader environmental awareness (Chen, 2005; Sarkis et al., 2011). This includes looking beyond traditional purchasing criteria, such as cost, quality and fitness for purpose, by taking into consideration additional social and environmental factors when making decisions, such as the whole life cycle of the product (discussed further in Section 2.5) and the broader implications for society and the environment (UN Interagency Procurement Working Group, 2006).

In the product development process, Foster and Green (2000) suggested that in-depth information about the environmental, social and economic impacts need to be gathered and processed. This information (including the product properties) is important and will normally be requested and supplied by external stakeholders (such as suppliers). For example, to provide relevant information to potential buyers of sustainable IT products, one must have knowledge of sustainability criteria for the products so it is easier for customers to decide what to buy. Therefore, to gather this information, staff members in procurement functions need to exchange information with those staff members who are expert in sustainability about green criteria and also with suppliers to identify available products that have the given criteria. Harms (2011) stated that, in a sustainable supply chain, this is a continuous process and requires knowledge and information to be transmitted and received within and beyond the organisation. It is believed

that the same process is required in sustainable procurement as it is part of a sustainable supply chain.

Developing sustainability-based selection criteria to support the procurement of products can help reduce environmental impacts and is considered fundamental by the European Union (EU). Tarantini, Loprieno and Porta (2011), for example, described how this was done in the case of the purchase of windows in building projects. The EU has suggested that information related to procurement criteria should be shared among consumers and buyers, in a form that can be easily accessed (European Commission, 2003).

New et al. (2002) highlighted the importance of having an environmental focus in the public sector. Even though much research has focused on the private sector, the public sector's spending on goods and services (5–15% of gross national product [GNP] on average) represents a major force. As noted above, we have decided to focus on the public sector in this research. Public sector organisations are easier for governments to control, and are required to follow rigorous and consistent procurement processes that, in the case of the UK, have to follow EU regulations. As shown by the drive for sustainable procurement, public procurement can be used as an instrument of the government's industrial and social policies (Heinritz, Farrell, Giunipero, & Kolchin, 1991).

Only a limited number of studies on sustainable procurement have been conducted in the public sector compared to those undertaken in the private sector (Walker & Brammer, 2009). These studies show how sustainability policies mandated by governments have been implemented. Table 2.3 below lists some of the research carried out in the public sector.

*Table 2.3: Existing research on sustainable procurement in public sectors*

(Author, Year)	Research Focus
(Michelsen & de Boer, 2009)	Investigated how green public procurement was implemented in Norwegian municipalities and counties and what the factors are that made green procurement successful
(Bala, Muñoz, Rieradevall, & Ysern, 2008)	Explained the strategy and procedures used by the Universitat Autònoma de Barcelona (UAB) to implement green purchasing practices for their supply chain
(Walker, Di Sisto, & McBain, 2008)	Explored the success factors for and barriers to implementing green supply chain management initiatives
(Oruezabala & Rico, 2012)	Investigated whether sustainable practices in public hospitals in France could impact on supplier management
(Preuss, 2009)	Explored the way that local government fosters sustainable development through the implementation of sustainable procurement
(Murray, 2000)	Examined the green purchasing strategy implemented by Belfast City Council
(Walker & Brammer, 2009)	Investigated sustainable procurement practices across the UK public sector
(Young et al., 2015)	Investigated sustainable procurement practices in UK and Australian universities
(Grandia, Steijn, & Kuipers, 2015)	Examined if the implementation of sustainable procurement could increase sustainable procurement behaviour among the Dutch
(Nijaki & Worrel, 2012)	Demonstrated how the local green economy can be developed by adopting procurement tools that consider the environmental aspect

As shown in Table 2.3, various domains of study have been involved, such as local government, councils, public hospitals and universities. However, to date, the amount of research conducted on sustainable procurement in higher education has been inadequate. From the list above, only two research studies were carried out in the higher education sector but these studies did not explore informed decision making in relation to sustainable procurement. The first one studied the implementation of sustainable procurement in Universitat Autònoma de Barcelona (Bala et al., 2008) and the second one compared sustainable procurement practices in UK and Australian universities (Young et al., 2015). Based on the findings of all of the papers listed in Table 2.3 above, sustainable

procurement is a promising practice in the public sector despite the barriers, such as higher cost and receiving commitment from all stakeholders.

Other research in sustainable procurement is starting to be explored in different domains, especially in the field of construction, probably after their procurement practices were criticised for neglecting the sustainability aspect in their project life cycle. Renukappa, Egbu, Akintoye and Suresh (2016) suggested that inter-organisational collaboration and the lack of knowledge and expertise in sustainable procurement in organisations mean that training will be necessary.

In addition, it is crucial to explore the key factors that lead to the successful implementation of sustainable procurement in existing business models. It is noted that implementing sustainable procurement to fit an existing business model is not an easy process (Renukappa et al., 2016). The current research is investigating the change strategy from traditional procurement practice to sustainable procurement. Therefore, it is relevant to say that, even after a sustainable procurement strategy is designed and is to be implemented, the possibility exists that the suggested strategy may not fit the existing business model; thus, the strategy would need to be changed. A study carried out in the Brazilian public sector found that the actual barriers to sustainable procurement implementation were the lack of support and training from top management (Aragão & Jabbour, 2017).

Several best practice guidelines have been recognised in sustainable procurement, including those developed by the Organisation for Economic Co-operation and Development (OECD) which caters to its members in developed countries (OECD, 2015). In the OECD's guidelines, six dimensions are explored and best practices taken from different countries are discussed in terms of their implementation. Among the key lessons is the importance of constant

involvement of and information to important people, such as suppliers, at all stages. The spreading of information about the advantages of having sustainable products could change consumers' perceptions towards sustainable procurement and this is seen as a key step to success.

Another best practice guideline from the US's Institute for Public Procurement discussed the elements to be considered to form sustainable procurement (Institute for Public Procurement, 2012). This best practice guideline recommends the following six elements to be implemented as the key to successful sustainable procurement: 1) people and leadership; 2) documentation of the drivers for sustainable procurement; 3) sustainable procurement policy, strategy and communications; 4) sustainable procurement processes; 5) engagement of suppliers; and 6) validation of achievement and measurement results in sustainable procurement.

In addition, a best practice document has been developed by the UK's Chartered Institute of Procurement and Supply (CIPS) (Alder & Gooch, 2013). In this document, seven elements are discussed that form the procurement cycle starting from identifying the product's risk through to contract creation. This best practice document recommends elements, such as identifying the product's risk; prioritising possible risks; identifying suppliers' criteria; evaluation; and contract creation. This cycle for best practice for sustainable procurement was adopted for our discussion in Section 5.4.1.

Based on the recognised best practices that are available, it is suggested that organisations wanting to implement sustainable procurement consider the suggestions and practice from best practice.



## 2.4 Sustainability Criteria

As noted earlier, this research has focused on sustainability criteria that relate to IT products. The use of IT hardware products, such as laptops, desktops and imaging equipment, in the UK public sector is extensive, with total expenditure of £2,143 million in 2011–12 (Office of Fair Trading, 2014). Thus, public sector buyers should be aware of the environmental, economic and social impact of using IT equipment, and their purchases should be influenced by taking into account the GBS criteria (refer Section 2.1.4). For example, the process of producing IT equipment is very complex and it is possible that the use of materials could release hazardous substances and may be dangerous to the environment.

Sustainability guidelines suggest that certain aspects of these areas need to be addressed to achieve the aim of procuring sustainable IT products. All sources of information that could support procurement decisions clearly need to be identified. This information needs to be integrated in order to form an information infrastructure to support sustainable procurement.

The Government Buying Standards (GBS) were designed to help buyers to procure in a sustainable way. The GBS provide an official specification that buyers across the public sector must follow when purchasing a range of products. All central government departments and their related organisations must at least meet the minimum mandatory specifications to purchase products. As previously mentioned, according to DEFRA (2013), around 50 standards are grouped into 10 priority product groups. The enforcement of the GBS by public sector organisations means that suppliers need to prove they are compliant with these standards; thus, this creates competition between suppliers in developing products that satisfy the requirement of reducing environmental impact.

The Office of Government Commerce (now known as Crown Commercial Service), which operated through the Government Procurement Service, had the role of

encouraging the UK public sector to use the GBS in selecting products to procure. At the university level, HEFCE encourages and supports education institutions to integrate sustainability in their practice (Bull, Meida, Holland, & Montfort, 2011). A person within these sectors who would like to purchase any product has the responsibility to make sure that it fulfils the sustainability requirements. However, the GBS only applies to products. In addition, criteria to be applied to suppliers are needed by buyers to procure sustainably, with these discussed elsewhere.

Besides the GBS, procurement guidelines, incorporating environmental and social criteria, produced by other organisations can be used to select sustainable products, for example, the EU Green Public Procurement policy; Procura+; International Green Procurement Network; etc. (UNEP, 2012).

According to a report by the United Nations Environment Programme (UNEP), sustainability criteria used in selecting products should be divided into two levels: 1) core criteria and 2) comprehensive criteria (Tepper et al., 2008). Core criteria are developed to be used globally while comprehensive criteria are specified for certain regions. The reason why comprehensive criteria are developed according to certain regions is to reflect the availability of IT products in different regions of the world (Tepper et al., 2008). Table 2.4 shows how UNEP defines both criteria.

*Table 2.4: Description of core and comprehensive criteria  
(Source: Tepper et al. (2008))*

Criteria	Purpose	Region
Core	“to address the most significant environmental and social impacts, and are designed to be used with minimum additional verification effort or cost increases”	Globally
Comprehensive I	“to represent the most comprehensive and ambitious approach that can be undertaken to achieve high sustainability performance for office IT equipment in Europe, North America and Latin America”	Europe, North America, Latin America

Comprehensive II	“to represent a more comprehensive and ambitious approach than in the Core criteria section that can be undertaken to achieve a certain sustainability performance for office IT equipment for South-east Asia, East Africa and the Middle-East”	South-east Asia, East Africa and the Middle-East
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Table 2.5 demonstrates one example of energy consumption criteria for IT products as suggested by the United Nations Environment Programme (UNEP).

*Table 2.5: Example of core and comprehensive criteria for IT products*

<b>Product</b>	<b>Mandatory/Core</b>	<b>Comprehensive</b>
PC, notebooks, computers	All products must meet the latest ENERGY STAR <sup>®</sup> criteria for energy performance	Additional points will be awarded: If the product is more energy efficient than specified in the latest ENERGY STAR <sup>®</sup> standards for energy performance

The next section discusses another important criterion that needs to be considered when making sustainable procurement decisions, which is whole-life cost.

## 2.5 Whole Life Cycle

One of the strategies to ensure sustainable procurement is successfully achieved is consideration of the whole-life costs of goods or services. At the time of purchase, price may be a key concern but the cost of purchase may be a small proportion of the costs that the product will incur during its lifetime. Therefore, product assessment should not solely rely on the lowest price but should consider the product’s cost throughout its life cycle (Williams, 2007). Tepper et al. (2008) stated that for office IT equipment the important things to consider are purchase price, the materials and energy used during the time of consumption, and the cost of disposal. Examples of these types of costs are: (Perera et al., 2009):

- acquisition/purchasing costs – delivery cost, installation, insurance
- operating costs – water and energy consumption, maintenance costs, annual fees
- disposal/end-of-life cost, for example, recycling, site clean-up cost, refurbishment, removal

The implementation of whole-life costing (WLC) in public procurement is crucial as it allows the setting of realistic budgets, covering the costs incurred from product purchase through to product disposal over a certain period of time (UNEP, 2012). A study carried out by Perera et al. (2009) on life cycle cost shows that it is considered for use in public procurement for several reasons:

- a. To produce environmentally and socially aware tender specifications that suppliers are required to meet.
- b. To develop indicators on which bids will be appraised.
- c. To justify the purchase of sustainable products that, although initially costly, provide the best value for money over the lifetime of the product.
- d. To identify if it is more worthwhile to buy an asset or to simply lease it. For example, some office equipment, such as photocopiers, might be leased as a service contract would normally cover maintenance, repair, replacement and end-of-life disposal services.

Perera et al. (2009), in their paper, highlighted the difference between whole-life costing (WLC) and whole-life assessment (WLA). The latter looks at the environmental impacts of products or equipment throughout their life cycle. The authors also noted that the tender that scores highest on WLC does not always score highest on whole-life assessment (WLA). Their paper, however, suggested that WLC does go some way to

supporting sustainable procurement. It is important and necessary to consider WLC in making informed procurement decisions to ensure low running costs and to reduce environmental impact (Tepper et al., 2008).

## **2.6 Accreditation Bodies**

Sustainable products are considered sustainable if they fulfil certain sustainability criteria. However, it is impossible for procurement managers to make a purchase decision by, for example, looking at the product to identify whether its raw materials are sustainable products or by tracking back along the supply chain as they lack expertise and information (UNOPS [United Nations Office for Project Services], 2009). Where information is available, problems still exist in making decisions. How do buyers evaluate conflicting product characteristics where product A is good in one way and product B is good in another? In this kind of situation, each sustainability criterion should be converted to a common measure, such as giving a score for each requirement and using the highest total score to make decisions (refer to Section 5.4.1). However, for important criteria, any product which does not meet that individual requirement must be rejected regardless of how good it is in other ways, for example, food products that contain life-threatening ingredients.

Environmental labels produced by certification bodies for IT products are helpful in determining the products' specifications. Environmental labels have been around for the past three decades—in relation to reducing climate change—but many procurement managers may not be familiar with these labels (UNOPS, 2009). Different categories of environmental labels are shown below (European Commission, 2016a):

1. Multi-criteria labels: These labels are the most common type used and are assessed based on scientific information about the environmental impact of products throughout their life cycle. Several criteria need to be fulfilled and

different labels cover different sets of criteria and different product areas, for example, Blue Angel, Nordic Swan.

2. Single issue labels: These labels are based on specific criteria and are assessed as pass/fail. The product displays the label if the requirements are fulfilled; for example, ENERGY STAR<sup>®</sup> criteria are specific to energy efficiency.
3. Sector-specific labels: The sector-specific labels are operated by organisations such as the Forest Stewardship Council (FSC).
4. Graded product labels: These labels are not based on pass/fail criteria but on specific environmental performance, for example, the EU Energy Label is used to grade energy-related products based on their energy efficiency.

According to the European Commission, a sub-group of environmental labels, known as eco-labels, such as Nordic Swan, Blue Angel and the EU Eco-label (the EU Flower), are the most appropriate for sustainable products as these labels take into consideration every aspect from design to disposal, in other words, life cycle considerations (European Commission, 2016a). However, guidance is necessary to clarify each type of label—what it means and how it can help in procurement decisions (UNOPS, 2009). Table 2.6 lists some examples of certification bodies/labels and provides a description of their role.

Ideally, accreditation bodies should provide the assurance that products with their certification labels meet the necessary requirements throughout the products' supply chains. For example, the American National Standards Institute (ANSI) is one body that approves standards (American National Standards Institute [ANSI], 2016).

Table 2.6: Examples of accreditation bodies and their functions

Accreditation Bodies	Role	Owner	Product Range
ENERGY STAR® (ENERGY STAR®, n.d.)	To identify and verify energy-efficient products and buildings.	US Environmental Protection Agency	A wide range of products such as appliances, electronics, office equipment, lighting, etc.
Forestry Stewardship Certification (FSC, n.d.)	To certify forests as meeting the highest environmental and social standards.	Non-governmental organisations (NGOs) (World Wide Fund for Nature [WWF] and Greenpeace), businesses (Tetra Pak and Mondi PLC) and social organisations (National Aboriginal Forestry Association of Canada)	Products from well-managed forests.
Nordic Swan (Nordic Ecolabel, n.d.)	To evaluate products' impact on the environment throughout their life cycle.	Nordic Council of Ministers	Many product group such as computers, imaging equipment, televisions, candles, dishwashers, etc.
TCO Development (TCO Development, n.d.)	TCO-certified is a verification of a specific model of an IT product and each verified model meets criteria in the manufacturing, use and end-of-life phases.	TCO Development, a non-profit organisation based in Stockholm, Sweden	Displays, notebooks, tablets, smartphones, desktops, all-in-one personal computers (PCs), projectors and headsets.
Electronic Products Environmental Assessment Tool (EPEAT) (Green Electronics Council, 2017)	The EPEAT provides environmental ratings for products and its assessment is based on the ANSI-approved public standard.	Green Electronics Council	PCs and displays (including tablets), imaging equipment (which includes printers, copiers, scanners and multifunction devices) and televisions.
Blue Angel (Blue Angel, n.d.)	Each label awarded to products or services specifies its focus on one of the four protection goals, namely, health, climate, water or resources.	Environmental Label Jury; Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety; Federal Environmental Agency; and RAL gGmbH	Many product groups such as home and living, electrical devices, construction, office, energy and heating, garden and leisure, and business.

An initial stage of procurement is selecting the product attributes that the buyer may consider. For example, the buyer who would like to buy a laptop would consider the ability to upgrade so that hardware components, such as memory, hard disks, CD and DVD drives are readily accessible and can be changed, thus extending the life of the machine (Tepper et al., 2008). The relevant possible criteria vary with each type of product, and eco-labels, as described in Table 2.4, or the equivalent can provide guidance.

The next section describes a generic model of sustainable product procurement in higher education (HE) that has been constructed from advice offered by various authorities.

## **2.7 Sustainable Procurement Process in Higher Education (HE)**

This research selected UK higher education (HE) as an example from within the public sector of how demands for sustainable procurement were being addressed. Sustainable procurement practice in UK universities often involves buyers, buying consortia and suppliers. At a more practical level, higher education institutions can be members of one of several regional buying consortia (e.g. the Southern Universities Purchasing Consortium [SUPC]) that were set up under the English National Purchasing Consortium (ENPC). Through collaborative procurement, university buying consortia undertake collective bargaining with suppliers so cheaper products can be obtained. A consortium assesses suppliers for inclusion in framework agreements that set out the terms and conditions for a specified period (HM Treasury, 2009).

UK higher education was found to be among the public sector organisations that needed attention to be directed to their sustainability practices. The use of energy from ICT-related products in higher education in 2009 produced more than 500,000 tonnes of carbon emissions, costing the sector £115 million; thus, being able to procure sustainable products is very important to reduce their carbon footprint which is not good for the



environment (Environmental Association for Universities and Colleges, 2011). According to the survey conducted by James and Hopkinson (2009), IT in higher education needs to be made more sustainable. Demands from stakeholders (e.g. the government, universities, HEFCE, etc.) are among the reasons. While the impact of IT on the environment needs to be minimised, the benefits of IT applications that support sustainability should also be maximised, for example, online meetings to save travel costs.

When higher education institutions purchase IT products, the standard practice is that suppliers are chosen from a list of approved suppliers that have established framework agreements with university buying consortia such as Southern Universities Purchasing Consortium (SUPC) (James & Hopkinson, 2009). This provides an example in which the process of choosing suppliers to be contracted is partly delegated to another body. The selection process by which suppliers are added to such lists may not involve identifying green suppliers. As a result, some universities ask suppliers additional questions about sustainability during the selection process. The fact that the list of suppliers approved by the buying consortia only caters for generic requirements is justified on the grounds that not all higher education institutions have the same level of sustainability requirements. Therefore, individual universities that want to choose suppliers conforming to their own requirements, as stated in their university buying guidelines, need to carry out additional assessments. The process of selecting the most sustainable products and suppliers could be simplified with the support of an appropriate information infrastructure. The procurement information model in Section 4.7 would provide a rough idea to the system designer so a system could be designed to guide the decision maker to the information needed.

## **2.8 Chapter Summary**

The implementation of sustainable procurement in the public sector can be seen as resulting from pressure from the central government which, in turn, has been influenced by international bodies (e.g. the EU and the UN). The UK central government has addressed environmental concerns by issuing environmental directives that require public sector bodies to procure in a sustainable manner. The government initiative to incorporate sustainability as a practice in public sector bodies can be seen as a step in setting a good example of sustainable procurement. Public sustainable procurement will impact on the private sector as common suppliers of public organisations. Thus, the private sector may have to comply with the government's policies to ensure that their products are sustainable so they can supply products to public sector organisations. Higher education (HE) institutions are the public sector organisations of interest in this research and are examined in more detail in the chapters that follow.

## **RESEARCH METHODOLOGY**

### **3.0 Overview of Chapter**

This chapter explains the case study approach used to identify the types of information needed to support sustainable procurement in UK universities. Universities were chosen as a particular example of the broader category of public sector organisations in the UK, in order to identify the problems that they experienced with procurement and how they attempted to solve those problems. This helped to gain an understanding of the information infrastructures (described in Section 4.7) used to support current procurement processes in UK universities, as well as providing a general understanding of the procurement processes. Interviews were the main method of collecting these data. The data analysis software NVivo was utilised to transcribe interview transcripts.

Social network analysis (SNA) was used to produce diagrams of the networks among key stakeholders in order to understand their communication pathways. Social network analysis (SNA) helped to identify the relative importance of individual roles in the procurement network.

Based on the data collected, the information architecture framework to support sustainable procurement was designed and is discussed in Chapter 4. As the university, for example, the University of Brighton (UoB), might move to a more sustainable model, we needed to find the difference between ‘traditional’ procurement and ‘sustainable’ procurement with the latter requiring access to a wider range of information in order for buying decisions to be made. The assessment needed to be done not only of the current practice but also of the practices that were going to be implemented. Goal modelling

techniques such as VMOST (*v*ision, *m*ission, *o*bjectives, *s*trategies and *t*actics) seemed to support this approach.

A goal model is the illustration of the link between what the organisation would like to achieve (*v*ision, *m*ission and *o*bjectives) and the steps that are actually implemented (*s*trategies and *t*actics). The B-SCP framework (based on the three themes of *b*usiness strategy, *c*ontext and *p*rocess) was then used to extend the modelling of strategy by adding to VMOST the information about context and processes.

The next section describes the case study method. Data for this study were collected using the interview approach and also from accessing archived documents. The content analysis method, used for analysis in the current study is also discussed in this section.

### **3.1 Overview of Case Study**

A case study approach was adopted in this research, as the data came from many sources such as interviews, government documents, university procurement policies, etc. A large in-depth case study was undertaken of one university and a number of smaller case studies were used to assess how typical the in-depth case study was.

Baxter and Jack (2008) stated that

“qualitative case study is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood.”

Young et al. (2015) stated that, based on the literature, very little research has been carried out on sustainable procurement, especially in UK universities. Two papers were identified in Young et al. (2015), one about procurement practices in UK higher education (HE) by Quayle and Quayle (2000) and the other in German universities by Glock and Broens (2011). Both studies used a questionnaire survey. However, a questionnaire survey was not attempted in our research as, in our view, the case study method would be

the most appropriate to explore and understand the phenomenon and investigate the details within the study's scope. To explore this phenomenon by seeking answers to the research questions outlined in Section 1.3, the recommendation from the literature was to use a case study approach. Benbasat, Goldstein and Mead (1987) appeared to recommend case studies in IS research when actual practices needed to be studied in their natural, complex settings and when little previous research had been conducted. As this approach allows a full understanding of the complexity of the phenomenon (Seuring, 2008), it is suitable for use in this research as we needed to understand the universities' procurement process in detail as well as identifying the information that they used. In addition, we needed to understand their procurement strategic plan: obtaining opinions from the key people in university procurement was also important. One type of case study is exploratory which allows the case to be explored and investigated in in-depth detail within its specific context.

Baxter and Jack (2008) discussed the steps that need to be considered when choosing a case study as a research approach. Firstly, the case study approach needed to be assessed in terms of its suitability for this research. According to Yin (1994), three conditions within our research would make it suitable for a case study, namely: 1) it depends on the nature of our research questions; 2) we could not control the behaviour of those involved; and 3) we sought to study within a real-life context.

In addressing the first point, we need to refer to our research questions as presented below.

**RQ1:** What would be the appropriate type of information and processes needed to support the sustainable procurement of goods and services by public sector organisations?

**RQ1.1:** What does ‘sustainable procurement’ mean in the context of UK universities?

**RQ1.2:** What are the typical current practices in sustainable procurement?

**RQ1.3:** What is recognised best practice in sustainable procurement?

**RQ2:** What are the ways to assess the alignment between the change programme and organisational goals?

This type of ‘what’ questions are suitable for the adoption of an exploratory case study approach (Yin, 1994). These research questions required the detailed exploration of procurement practices in public sector organisations in order to identify what information was being used. The second research question involved further exploration of the procurement process in a real-life situation to evaluate if they were taking the right steps to fulfil their sustainability objectives.

The next step, as explained by Baxter and Jack (2008), is to set the boundary of the case. In this research, we set the boundary by only selecting universities in the United Kingdom (UK). The purpose of setting a boundary is to avoid working across a very broad area of research or to ensure that answers are not being sought to too many objectives.

After working on the scope of the research case, we needed to choose the appropriate type of case study. Yin (1993) described three types of case study: 1) exploratory; 2) explanatory; and 3) descriptive. Another three types of case study:

1) intrinsic; 2) instrumental; and 3) collective were described by Stake (1995). Table 3.1 below describes the types of case study as explained by Baxter and Jack (2008).

*Table 3.1: Descriptions of types of case studies*

<b>Type of case studies</b>	<b>Explanation</b>
Exploratory	Used to explore any phenomenon that is new or with very limited study undertaken of the research topic. Suitable to answer 'what' questions (Yin, 2003)
Explanatory	Suitable for the type of research that seeks an explanation to answer the questions. Mostly used to answer 'how' and 'why' questions (Yin, 2003)
Descriptive	To describe the real-life context of the situation or phenomenon (Yin, 2003)
Intrinsic	The case studied in the research is the primary interest of the research. The interest is in exploring the case itself rather than using the case to represent other cases (Stake, 1995)
Instrumental	The case is studied to provide insights or understanding about something else (Stake, 1995)
Collective	A collection of similar case studies is studied. This is used to describe multiple case studies (Yin, 2003)

Tellis (1997) outlined three steps in the case study method, which are:

- 1) Design the case study
- 2) Conduct the case study
- 3) Analyse results based on the evidence

A case study can consist of either a single case or multiple cases. The difference between these two types of case studies is the number of contexts and case(s). A single case study explores one case in one context; however, a multiple case study involves many contexts with a case in each context (Yin, 1994).

### 3.2 Case Study

Referring to Table 3.1, in this research, we used a mix of case study methods to explore the current practice of procurement in universities as a starting point before we examined their transformation plan from traditional procurement to sustainable procurement. An exploratory case study was used in the beginning to explore the current procurement practice in universities: an explanatory case study was then used to describe the cause and effect of the implementation of the procurement strategic plan. An exploratory case study is suitable for a study on a research topic for which only a small number of studies can be found in the literature (Preuss, 2009). As mentioned by Young et al. (2015) and Preuss (2009) in their papers, limited research has been carried out on sustainable procurement in the public sector, especially in universities. Preuss (2009) investigated local authorities which is a broader sector. He used structured interviews for data collection while Young et al. (2015) used focus groups and in-depth interviews in the UK and Australia.

Our case research was restricted to public universities in the United Kingdom (UK). Universities provided an interesting and convenient example of organisations that practise public procurement in the United Kingdom (UK). The amount of published research was limited on how sustainable procurement decisions were actually made in the university sector as opposed to how those decisions should be made. The current research was focused on the types of information being used in university procurement and on assessing the steps being taken towards sustainable procurement and its impact on information needs. As explained earlier, the current research started with an exploration after which the aim of this research was to understand the action taken to implement sustainable procurement; hence, the choice of exploratory case study was well suited to answer the research questions (Preuss, 2009).

To answer the research questions, as outlined in Section 1.3, we needed an appropriate case study design that was designed in such a way that the types of



information required to make effective decisions would be identified. To answer the first research question on the type of information needed to support sustainable procurement decisions, we developed questions to gain a full understanding of how procurement practice is undertaken within the university and by its suppliers. At this stage, we explored the process and context of the study in detail. We also used a social network analysis diagram (refer Section 3.7) to identify the relevant context of the study. However, more explanation was needed to answer the second research question about the way that the strategic plan were implemented and the steps or tasks that needed to be carried out. We mapped the strategic plan to a goal model to find the links, and interviews were carried out to obtain the explanation and also to validate our findings.

Multiple case studies were used in this research to study procurement practices at different university sites. Each site was treated as an individual case but the whole study was subject to multiple case design (Yin, 1994). Following the four steps in case study method introduced by Tellis (1997), each step of the case study method for our study is explained as follows.

1. Design the case study

Prior to developing questions to answer RQ1 and RQ2 (Section 1.3), an exploratory study was conducted. Extensive reading was undertaken on related topics, such as university procurement, sustainable procurement in the public sector and knowledge/information management (refer Section 2.0).

2. Conduct the case study

An initial survey was conducted at the University of Brighton (UoB) before we went to other UK universities. Interviews were conducted with a number of staff involved directly or indirectly with university procurement. Open-ended questions were asked with the answers used to gain an understanding of the whole

picture of how the current procurement process is carried out. Open-ended questions allowed the interviewees to give their opinion of the topic discussed (Tellis, 1997). The detailed process of the interview protocol is discussed in Section 3.4.

### 3. Analyse results based on the evidence

After data were collected via interviews with relevant people, they were analysed using the software tool NVivo 10. The steps taken to analyse data are explained in Section 3.6.

### 4. Draw conclusions/recommendations based on evidence

It is important that readers clearly understand the implications of the research. Reporting the conclusions and recommendations of the research is critical as it connects readers with the researchers (Tellis, 1997).

## **3.3 Data Collection: Interviews**

The key approach to data collection involved: 1) an in-depth study of sustainable procurement at the University of Brighton (UoB); and 2) a less deep, but broader, survey of other higher education institutions to see the degree to which the UoB procurement approach was typical. Data collection also involved multiple case design with each university treated as a single case but with the same context for all cases. In-depth interviews (Berry, 1999) were conducted to investigate how the procurement process was done and how sustainability was integrated into procurement practices.

The University of Brighton (UoB) was chosen as the public sector organisation with which to start the exploratory data collection, the main reason being ease of access. A key objective of the data collection protocol was to identify the networks involved in sustainable procurement. The network boundary was restricted by an initial focus on IT

procurement. A procurement department in the UoB was the main entry point to the procurement community, but we found another community in the UoB involved with sustainability development issues. Little overlap was apparent between the two.

Data collection began by conducting initial exploratory interviews with the key people at the UoB involved in sustainability development and procurement activities. During each interview, the snowballing technique (Prell, 2012) was adopted to identify the next people to be on the interview list. This technique required the interviewee to nominate the names of other people who might be relevant. Interviews were then scheduled with those nominated by the interviewees from the two communities identified above.

Our interviewees consisted of people in different roles and from different backgrounds, from the sustainable action network coordinator to clerical staff involved in fulfilling procurement requests from the users and also those involved within the UoB in sustainability action groups.

At this stage, we set the network boundary to cover only those involved in sustainability development or the procurement processes in the organisation. The boundary was further restricted by focusing on IT procurement. Two sets of open-ended questions were designed to cater for the interviewees involved in each network. All interviews were conducted face-to-face either in the interviewees' offices or in a café near where their offices were located. The interviews ranged from 30 minutes to one hour.

During the interviews, a voice recorder was used to capture all of the information provided and it was then transcribed into text. The transcriptions were then compared to the audio file to check on their accuracy.

After some preliminary interviews, a clearer view of the procurement process was obtained and, based on this, the questions were modified. The restructured interview protocol allowed the interviewer to ask more focused open-ended questions.

The research instrument was subsequently re-structured once again for a survey of the views of procurement managers from other UK universities. This was designed to assess the extent to which the UoB procurement process was typical of the practices of the broader UK university procurement sector.

Important initial findings were the lack of overlap between the procurement and sustainability communities and the habit among staff who wanted to purchase IT equipment to delegate responsibility for assessing the green characteristics of candidate products to the experts in the central university IT service so that the decision-making process involved in buying sustainable products was treated as a “black box” (Hughes, Cox, & Akhir, 2014; Rice, 2011). The analysis of interview transcripts also confirmed that effectively delegating the tasks of identifying the product criteria related to sustainability and assessing product compliance is a common practice.

### **3.4 Interviews: UK Universities**

As noted above, the interview protocol developed for surveys at the University of Brighton (UoB) was modified for data collection from a sample of procurement managers at other universities. We approached five UK universities and a purchasing consortium in addition to the University of Brighton (UoB). Table 3.2 below shows the list of organisations and higher education institutions that we have approached.

*Table 3.2: List of UK organisations/institutions approached*

No	Organisation/Institution	Code
1	University of Brighton	U1
2	University of Sussex	U2
3	University of Exeter	U3
4	Bournemouth University	U4
5	University of Bristol	U5
6	University of Reading	U6
7	Southern Universities Purchasing Consortium (SUPC)	C1

The respondents were asked about the process of sustainable IT procurement in their university, starting from when a purchase request was created by a staff member. Descriptions were elicited during the interviews of the types of information needed and available to them to make purchase order decisions. These data helped to identify the relationships between different pieces of information and among their sources which amounted to an information network for procurement decisions. To represent these networks in diagram format, social network analysis (SNA) was used.

An example was the identification of the important role played in university sustainable procurement by university purchasing consortia such as the Southern Universities Purchasing Consortium (SUPC). This led to an SUPC representative being interviewed, with the interview protocol further extended to capture additional information relating to framework agreements negotiated by purchasing consortia with suppliers. Information related to products, such as criteria selection, was also captured.

### **3.5 Contextual Information**

In addition to interview data, documents related to sustainable procurement, such as sustainable procurement policy documents and university buyers' guides, were also

collected. It is in the interests of organisations concerned with best practice and governance to make these documents accessible via the internet using search engines. Government documents such as EU and UK legislation (refer Sections 2.1.1 and 2.1.2), the HEFCE carbon reduction initiative and sustainable procurement guides from DEFRA (refer Section 2.4) are examples of the sources used. The use of multiple sources of data helped with our understanding of the interview data. It also extended the information network by identifying new (institutional) stakeholders. These documents were then copied into NVivo 10 to be coded along with the interview data.

The interview data and the documents transferred to NVivo software were then analysed to identify the types of information needed when choosing sustainable IT products.

### **3.6 Content Analysis**

Content analysis has been defined as “... a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005). According to Zhang and Wildemuth (2009), the process of content analysis begins from the early stages of data collection. In the current study, it was important to make sure that the data collected met the objectives of the study when being coded (Miles & Huberman, 1994). Qualitative content analysis involved a series of systematic procedures to ensure valid and reliable inferences for data processing (Zhang & Wildemuth, 2009).

As noted above, interview data were transcribed verbatim to make sure all information was recorded. To analyse these transcripts, software known as NVivo 10 was used. Content analysis needs a coding scheme to be developed. In this case, for example, to identify the types of information needed to choose sustainable IT products, relevant words needed to be coded and words with a similar meaning or a close relationship needed

to be grouped together. For example, the two statements below could be coded as “Power Consumption” and placed in the “Product Criteria” category.

*“how much electricity it will use ...”*

*“we want to use a PC which has low consumption of electricity, for instance, has very low standby consumption ...”*

Another example was statements about finding the sources and types of information. Therefore, relevant data were highlighted and categorised in the relevant category. In this case, this information was categorised as “Sources of Information” and then “Product, Manufacturer, Suppliers, Buying Consortia, Accreditation Bodies, University, etc.”. Everyone on this list is an organisational actor (i.e. they are people or groups of people) except for “Product”. It could also be argued that most of the information about a product actually comes from the manufacturer.

From “Sources of Information”, we found the types of information that could be derived from each group. For example, the types of information that can be derived from “Product” are “Product Manufacturer”, “Product Specification” and “Product Model”.

### **3.7 Social Network Analysis (SNA)**

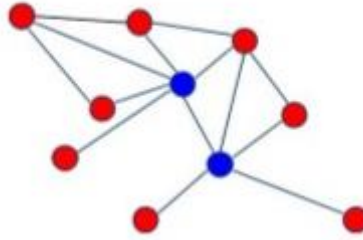
At the beginning of this research, it seemed likely that enhancing procurement decision making to take account of sustainability was essentially a matter of appropriate knowledge management. We found some researchers who argued that identifying and analysing the pattern of communications within the knowledge management processes in an organisation could be facilitated by social network analysis (SNA) (e.g. Anklam, 2002). However, the communications that took place between organisations were as important as those that occurred within organisations, in this research context. A disadvantage of formal organisational charts in organisations is that they do not show

knowledge flows. However, SNA could help to map more accurate networks of the knowledge flow (Chan & Liebowitz, 2006). The initial intention was to use SNA as a means of assessing collaborations between the key stakeholders that could support the development of 'green' supply chains. However, an approach based on gathering detailed data from all stakeholder organisations in an entire supply chain seemed over-ambitious, so we took a strategic approach to our scope to focus on the interface between a single organisation and its suppliers, that is, the organisational procurement process. Social network analysis (SNA) was used as a tool to identify and understand the communication pathways among the key stakeholders involved in the organisation and to map the communication between them (Borgatti & Li, 2009; Carter & Ellram, 2007).

Social network analysis (SNA) is a powerful tool that can help organisations to identify their internal key players (e.g. employee roles) and external players (e.g. suppliers). It is one of the approaches or tools that focus on the exchange of resources among actors (Haythornthwaite, 1996).

Thompson (2003) described the technical structure of SNA as "clusters". The structure is a form of network that gathers actors with similar characteristics or attributes, with SNA representing relationships as networks. For example, to discover the frequency of communication between students and lecturers for a certain course, we could draw an SNA diagram based on the data we have collected. Students and lecturers would be the actors and the link would show that some communication happened between them. Figure 3.1 below shows an example of the SNA diagram.





*Figure 3.1: Example of SNA diagram*

Social network analysis (SNA) is also a set of tools for mapping important knowledge relationships between people or departments—which would be particularly helpful for improving collaboration, knowledge creation and knowledge transfer in organisational settings (Cross, Parker, & Borgatti, 2002). Knowledge should flow among the people within the organisation to enable it to be shared easily (Tsai & Ghoshal, 1998). To ensure knowledge transferability happens at the right place and between the right people, SNA can act as an appropriate tool to measure the amount of information passed between individuals. As described by Haythornthwaite (1996), resources exchanged can be tangible or intangible and all relationships exchange a particular type of resource.

Those who exchange resources are known as actors, and they can be individuals, organisations or groups. When the information passed between individuals is measured, it allows the identification of the key players in a network, that is, those who communicate the most with other people in the network.

For example, a company may be linked to another company through the exchange of knowledge or information. In this case, companies are called actors and knowledge or information is called resources. Using SNA as a tool to map all the relationships in a network may enable us to see what kind of information is exchanged and between whom, and indirectly these patterns show how resources move around in the network and how actors control the flow of relationships (Haythornthwaite, 1996). Referring to the process of sustainable IT procurement described in Section 4.2, it can be concluded that in the

network of our study, information and knowledge are the resources to be exchanged among the actors who include individual buyers, university staff, the schools within a university, central IT services and suppliers.

Social network analysis (SNA) allows organisations to understand the connections between their actors that can either assist or hinder knowledge creation and transfer (Cross et al., 2002). By mapping all the interactions occurring in the organisation between employees, it is possible to identify the person who is being referenced most by employees and with whom they collaborate to undertake tasks (Busch & Fettke, 2011). In SNA terms, these are called “strong ties”. However, the most referenced person may become the critical source of information that could lead to a massive amount of information requests. This situation might cause the person to become stressed to the point where they became a bottleneck which would prevent knowledge creation (Cross et al., 2002). However, Granovetter (1973) argued that weak links/ties can also be important. As stated by Granovetter (1973), “those to whom we are weakly tied are more likely to move in circles different from our own and will thus have access to information different from that which we receive”. Haythornthwaite (1996) suggested that a network of information exchange will normally have both strong and weak ties. Strong ties show the willingness of the actor to share information, while weak ties enable us to have access to different kinds of information due to their connections with other networks. In our research context, an example of a strong tie was the Information Service staff with whom many other actors would communicate to request different information regarding purchases such as the ‘best buy’ recommendation and specifications of equipment, while the Division Leader might be considered as a weak tie. However, the Division Leader has a very important role to approve any purchase requests from the school.

Other than identifying the network of key players in sustainable procurement and the chances of collaboration in the organisation, SNA is also a potential tool for tracking

groups of people who are supposed to interact with each other but fail to do so, for example, people in different departments who place procurement orders. Importantly, we were able to track those to whom they preferred to communicate instead. We could also identify those who had the potential to cause bottlenecks for the whole network. Social network analysis (SNA) is able to aid the organisation in improving the way that it shares knowledge by re-structuring the organisational hierarchy based on the information obtained from the social map (McGregor, 2006).

The process of improving the way that knowledge is exchanged can be done using social software. This can facilitate communication with and among the actors to increasingly become a two-way communication flow (Schmidt & Nurcan, 2009). Often in an organisation, people are working differently to the documented workflow. The use of social software can help organisations to address the issues arising from this (van der Aalst, Reijers, & Song, 2005; Schmidt & Nurcan, 2009) by modelling the communications between those people and finding ways to improve them (Busch, 2010).

Prior research has identified evidence that SNA is able to improve relationships in the supply chain and can strengthen collaboration in a supply chain as a whole (Capó-Vicedo, Mula, & Capó, 2011). The research carried out by Capó-Vicedo et al. (2011) on improving knowledge management in supply chains using SNA shows that knowledge exchange between organisations can be derived from the analysis of inter-organisational relationships as networks. Capó-Vicedo et al. (2011) proposed a social network-based model to improve knowledge management of a supply chain formed by small and medium-sized enterprises (SMEs). All actors in SNA should have access to information for decision making. The informal linkages/communication developed between the organisations can generate new ideas and help in efficiently managing sustainable procurement. Borgatti and Li (2009) explained the implementation of SNA in the supply chain. Their paper discussed how SNA can be applied to supply chains (e.g. how to relate

SNA terms to real-life supply chain networks) and how supply networks work similarly to ecology (food webs).

Koehly and Shivy (1998) summarised the four major characteristics of SNA: 1) actors in SNA are interdependent on each other; 2) relationships or links between actors are very important and represent the path of resources; 3) the structure of relationships influences communication that occurs between actors; and 4) the structure of networks built by relationships between actors leads to other factors, namely, economic, political and social structures. Based on the characteristics above, Busch and Fettke (2011) recognised that the second and third key points can support knowledge exchange, thus leading to business process improvements. According to these authors, understanding business processes will contribute to our research in terms of the role of knowledge management in sustainable procurement.

To date, SNA has been used in a variety of research. The following examples present some of the existing SNA research in various industries. A study by Lin et al. (2012) to bridge the gap between social scientist and computer scientist explored the aspects of existing social networks that provide insights into how they interact in their professional lives.

Business process modelling methods have commonly been utilised for the process of analysing existing knowledge exchange in organisations. In some cases, SNA could be an alternative approach. Knowledge creation and sharing can be improved using SNA, as mentioned by Cross et al. (2002). When used to map relationships in organisations, SNA thus enables the researchers to identify the most feasible ways of improving knowledge creation and sharing. Precise social and technical interventions are identified to improve a network's ability (e.g. skill profiling systems, corporate yellow pages, peer reviews, etc.). Other than its role in supply chains, SNA can also be used in logistics research (Carter & Ellram, 2007). In their research, Carter and Ellram (2007) provided an example

of the use of SNA in an organisation which implemented an inbound logistics reporting system that emerged in response to concerns about warehouse safety and other environmental concerns. Their finding showed that a significant positive relationship existed between centrality (the most referenced actor) and influence. Thus, from their study, it can be concluded that in an informal logistics project, network centrality is more important than an individual's rank or years of tenure in the organisation. The people with network centrality show that they have most of the resources that other people in the organisation need which is why they are the most referenced actor. In addition, centrality might show that they are the key person or that they have much more knowledge than everyone else. This could be related to our research in relation to managing knowledge in the procurement network.

Apart from all the benefits of SNA discussed above, we did not use its numeric techniques but considered SNA as a tool from its qualitative perspective where it was used to identify the key stakeholders for the procurement network.

While it is interesting to discuss the benefits of SNA, we still need to be aware of its limitations. Some SNA limitations are discussed in the next section.

### **3.8 Limitations of SNA**

The use of SNA as described above helped the current study in the identification of channels of communication and the sources of information used when making purchasing decisions. However, as suggested above, the technique had limitations and other useful information, for example, about the processes carried out by procurement decision makers, had to be extracted from interview data using more generic content analysis.

Obviously, pros and cons can be found with any methodology, including social network analysis (SNA). In research, we often adopt a method for the reason that it might be very suitable for our research but at the same time we need to know its limitations.

Thompson (2003) described one limitation of SNA: “SNA is better at describing a certain manner of coordination between entities than accounting for their governance, where that coordination is itself rather ‘passive’ in character”. However, Haythornthwaite (1996), in his paper, stated that SNA focuses on the patterns of relationship that helps to identify who works with whom and who exchanges resources with whom. Other than the limitations described by Thompson, another issue to be discussed is the accuracy of social network data. The issue of inaccurate social network data was discussed by Bernard, Killworth and Sailer (1979, 1982; Bernard & Killworth, 1977; Killworth & Bernard, 1976) in their papers, arising from their observations of the interactions that occurred among their selected respondents in different communities. The same people were also asked to report on their interactions. Their research finding concluded that people’s reports about their interactions were incorrect about 52% of the time. It is important to highlight, for example, that because people may receive many emails from one person that does not mean that the person is necessary important in their work. Therefore, the interview technique discussed in Section 3.3 is appropriate as a basis for drawing networks, as mentioned in Section 3.7.

However, Freeman, Romney and Freeman (1987) argued that the most important thing to focus on is the stable long-term patterns of interactions, not the particular interactions of individuals. They argued that the results of reports in which respondents recall their interactions should be understood using the principles of memory and cognition. They found that what people report about their interactions is related to the long-term social structure rather than to particular instances. Krackhardt’s (1987) solution was to get everyone’s opinion about everyone’s relationship with everyone. Therefore, if a person claims to be friends with everyone, but everyone else agrees that the person is friends with no one, we have a clue that they might be lying or misunderstanding the question. Before SNA was used in analysing relationships between or within

organisations to improve the process of knowledge management, business process management (BPM) was used to model relationships. Having discussed Krackhardt's (1987) solution above, we, however, did not adopt his approach in this research as the use of SNA was solely to identify the key stakeholders in the procurement network.

In addition to SNA, another technique used in this research was goal modelling. The next section discusses the goal modelling technique that was used to model the UoB's sustainable procurement strategies.

### **3.9 Goal Modelling**

Goal modelling was used in the current research to capture the requirements of a system domain when implementing a sustainable procurement policy and then analysing the achievement of the objectives (Baïna, Ansias, Petit, & Castiaux, 2008). Several modelling notations have been developed to identify IT and business strategies implemented by an organisation, and the degree to which they meet organisational goals (Horkoff & Yu, 2011). Thus, aligning the IT and business strategies of organisations could help in improving business performance (Bleistein, Cox, & Verner, 2005). This approach was used in this research to identify the strategies that a university utilised in implementing sustainable procurement.

Based on the explanation by Bleistein, Cox and Verner (2005), this research used the *i\** approach as its entities are parallel to conceptual entities in the business motivation model proposed by the Business Rules Group (BRG). The BRG model describes organisations' motivation in terms of strategies, then aligns them with IT (Bleistein et al., 2005). The link between actors and the organisational plan can be represented using the goal model and this could help organisations to achieve their objectives. However, some problems occur with using *i\** as it is quite difficult to apply to a complex system due to its nature of mixing some of its elements, such as goal and task, with this addressed by

mapping  $i^*$  to the BRG model. In order to decompose business strategy from documents or interviews, the VMOST technique (*v*ision, *m*ission, *o*bjective, *s*trategy and *t*actics) is proposed. The VMOST technique helps to capture the business strategy of organisations and transforms them into entities that are similar to those in the BRG model.

### **3.9.1 B-SCP framework**

The acronym ‘B-SCP’ stands for *b*usiness strategy, *c*ontext and *p*rocess and is a framework used in requirement analysis that is based on these three themes of business strategy, context and process which can be used to verify and validate the alignment of business strategy and business process to achieve that strategy (Bleistein, Cox, Verner, & Phalp, 2006). The description of each theme and the technique used is explained in Table 3.3. The way they are interconnected is explained in Bleistein et al. (2006b).



Table 3.3: Description of B-SCP theme

<b>B-SCP Theme</b>	<b>Description</b>
Business strategy	<p>“How the organization intends to use IT to compete within its market or industry” (Bleistein et al., 2006b)</p> <p>Use <i>i*</i> notations to classify goal, task, resource, soft goal, actor and dependency (Bleistein et al., 2006b)</p>
Context	<p>“The business and organizational environment in which the organization operates” (Bleistein et al., 2006b)</p> <p>Use the concept of Jackson’s problem diagram (Bleistein et al., 2006b)</p>
Process	<p>“Business activities, their support systems and other organizational resources, roles, entities, and the interactions among all of these” (Bleistein et al., 2006b)</p> <p>Use the role activity diagram for the process phase (Bleistein et al., 2006b)</p>

The B-SCP framework mapped the requirements of the existing system but in this research, the B-SCP framework is applied for a different concept—to map the change of program in order to have a new system in place.

### 3.10 Chapter Summary

This chapter has outlined the research methodology used in this research, in terms of the process used to collect research data. The chapter has presented the type of case study and how the data were analysed, the use of social network analysis (SNA) as a tool to identify the key people and the use of goal modelling to evaluate the process of the transformation of procurement practice. Goal modelling was integrated with SNA to produce the goal context that is discussed in Chapter 6 (Section 6.6). The steps performed in this chapter are crucial as it leads to the research findings and results.

## CASE STUDY

### 4.0 Overview of Chapter

This chapter explains the findings of our case study on the University of Brighton. The procurement system evolved during the course of the research. This chapter discusses the original procurement processes that were found and documented in a role activity model. The use of social network analysis (SNA) in this research is explained and the scenario is explained based on the information model. The findings of the research processes, in particular, the content analysis of the interviews, described in the last chapter in terms of the methodology, are also presented in this chapter. The findings are summarised in the form of:

- a role activity diagram (RAD) of the procurement process (Section 4.2)
- an information model to support sustainable procurement decision making (Section 4.7)
- an SNA diagram showing the interactions between key actors in the procurement process (Section 4.8).

### 4.1 University of Brighton (UoB)

The use of energy from ICT-related products in higher education (HE) produced more than 500,000 tonnes of carbon emissions in 2009 which cost universities £115 million; thus, procuring sustainable IT equipment is considered very important to reduce the carbon footprint which is not good for the environment (Environmental Association for Universities and Colleges, 2011). According to the survey done by James and Hopkinson

(2009), IT in higher education needs to be made more sustainable, with demand from influential institutional stakeholders, such as the government and universities, one of the reasons (Higher Education Funding Council for England [HEFCE], 2010a). While the impact of IT on the environment needs to be minimised, the benefits of IT applications in achieving sustainability should be maximised. Thus, the development of the information model, presented in this chapter, is intended to support the decision-making process in minimising the impact of IT on the environment.

The procurement process model is validated by comparing the process with other UK universities (refer Section 5.3), while the information model is validated by comparing the practices of other UK universities with the interview data in Section 5.4 and the construction of scenarios in Section 4.9. Before proceeding to these findings, we next discuss the information sources of Information Services at the UoB as they are responsible for handling all the queries related to items to be purchased. Therefore, their staff should be able to answer all such queries. To ensure that they are aware of the latest technical information, their information should be from a variety of sources.

## **4.2 Procurement Process Modelling**

Procurement process modelling, as shown in Figure 4.1, demonstrates the original procurement processes at the University of Brighton (UoB). The procurement process at the UoB is centralised but with a devolved budget strategy whereby university departments pay for items that are purchased on their behalf.

*... We operate a centralised purchasing devolved budget strategy and we will purchase within those contracts ...*

*... the requisition is authorised and the PO [purchase order] is authorised, so you place the order and you pay them and you get the money back from the*

*department ... (University IT Service Officer, personal interview, 15 February 2013).*

Thus the purchasing process, particularly at its earlier stages, might differ in its detail depending on the school. The descriptions here reflect the practice in the School of Computing, Engineering and Mathematics (CEM).

In the case of CEM, the School comprised three Divisions. A School resources group was chaired, in rotation, by a Division Leader. The focus of this group was planning how to spend their yearly capital budget. In the Computing school, there were representatives of each Division who collected lists of what staff wanted to buy (e.g. PCs). Once representatives had completed their lists, the committee considered them. If the total cost of purchase requests exceeded the budget, the committee prioritised them. The Head of School then approved how the money would be spent based on the group recommendations (Head of Learning Environment, personal interview, 26 November 2012). The quote from the interview is as follows:

*... Our representative collected together of the list of what computing wants.. and he then goes to the committee, they argue, discuss because normally staff want more than this budget ... they prioritise things ... ultimately the Head of School decides how he is going to spend the money based on the recommendations of the groups ...*

The formal process of IT procurement in UoB was triggered when an approved requisition was received by procurement department from the School or other university department. The process was now coordinated through eFin, an electronic ordering system. A budgetary authorised officer in the department recorded the Head of School's authorisation of a requisition (that is a purchase request) through the eFin. Once authorised, it was passed, in the case of IT products, to Information Services so that they could raise a purchase order from the requisition before being passed to the suppliers.

Suppliers were chosen from those covered by the purchasing Framework Agreement negotiated by SUPC with approved suppliers. If there were no suitable suppliers listed in the framework agreement for the item needed, the Information Services officer needed to look for new suppliers. Then, the purchase request was passed to procurement department to raise an eFin requisition.

Information Services was a central place where all the products were received from the suppliers. The products were then delivered to the end users. Finally, an invoice was sent by the supplier and finance officer will deal with the cross-charging.

As mentioned above, the procurement process shown in Figure 4.1 is the practice of UoB. However, to create the information model, it is important to refer to the practice as shown but only the information used to make procurement decision will be considered to be included in information model. As an example, based on the procurement process model, the process to find laptop suppliers are:

*Request suppliers list (staff member) > Receive request (Information Service) > Retrieve SUPC suppliers' list (Information Service) > choose suitable suppliers (Information Service)*

The above pathway is the process to find the laptop suppliers under SUPC framework agreement. The information needed by each process was documented in the information model to be discussed in Section 4.7.4.7 Information Model

### **4.3 Information Sources**

Staff in central IT service of UoB had to equip themselves with updated technical information since people will go to them to get advice about things to purchase. They will normally get a lot of information from their suppliers especially when they deliver the items to the staff or sometimes the suppliers may send out the information through.

Sometimes, pamphlet sent out by the suppliers could help staff in updating themselves on related information. IT or hardware review site are among the ways used by the staff in getting the related knowledge.

Hewlett-Packard (HP) is one of the major suppliers in UoB for desktops and laptops. In 2011, when HP had a short supply issue with hard disk drive because of flooding, they took the initiatives to update their buyers with related information on their supply status. This could help staff in UoB to update their knowledge on current issue as well. However, it is done through our suppliers as UoB do not contact HP directly but deal with the authorised HP suppliers. Basically they have done a contract to supply HP equipment, and they named HP on the framework as the suppliers.

Finally, the next section will discuss about purchasing consortia in UK universities and its importance in providing framework agreement with universities procurement.

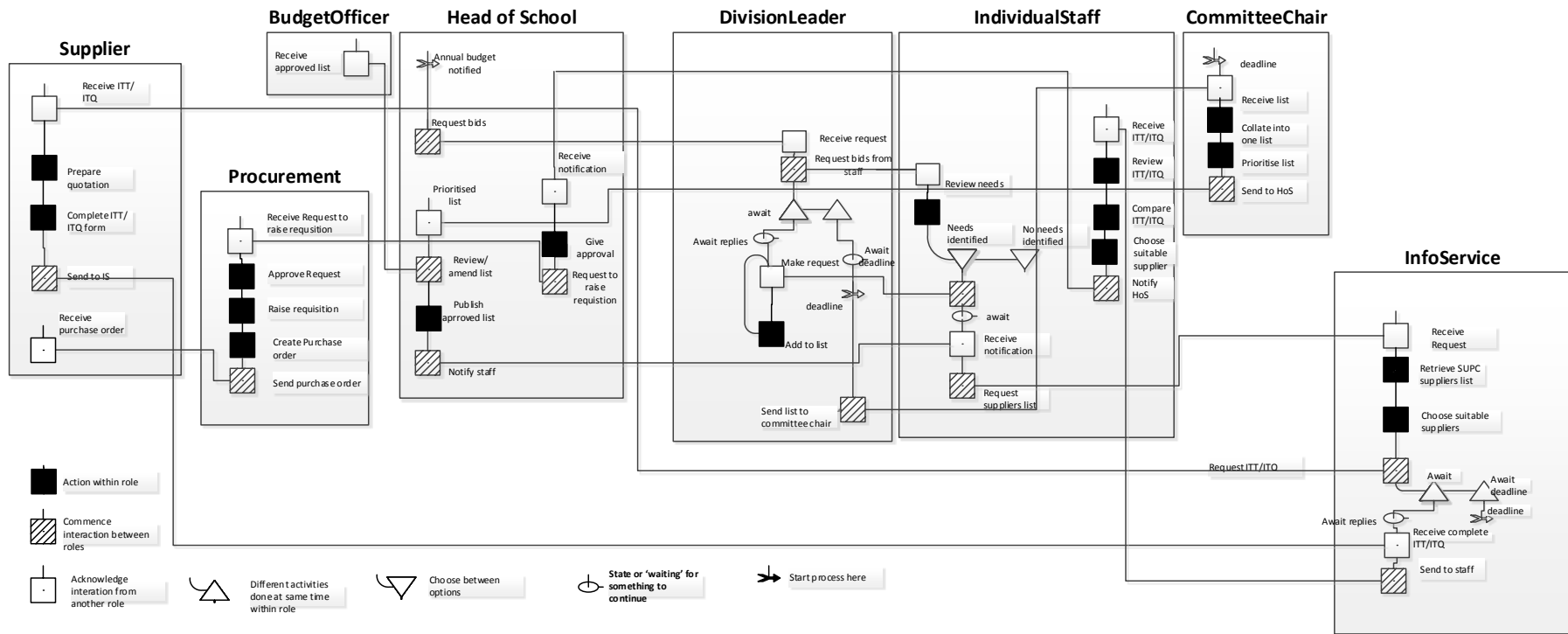


Figure 4.1: Role activity diagram of UoB procurement process

#### 4.4 University Purchasing Consortia

Several buying consortia for higher education have been formed in the UK. Among them are Northern Universities Purchasing Consortium (NUPC), London Universities Purchasing Consortium (LUPC) and Southern Universities Purchasing Consortium (SUPC). All of these consortia are committed in promoting sustainability in all of their activities, such as promoting sustainable policy to its members, suppliers and students (Southern Universities Purchasing Consortium, 2016a).

In order to support sustainability, SUPC has embedded sustainability in the procurement process by including some of sustainability questions in their pre-qualification questionnaire (PQQ). The suppliers need to provide the evidence of their environmental policy to be evaluated. However, there are no criteria of how their environmental policy should be like.

The supplier had to guarantee that their products met GBS criteria; that is, the buck was passed legally to the supplier to meet the sustainability criteria laid down by the government. SUPC also has implement policies and procedures to support other sustainability issue, not restricted to environmental issue only. Other issues supported by SUPC are (Southern Universities Purchasing Consortium, 2016b):

1. Human rights in supply chain including slavery and child labour
2. Remove barriers to encourage participation of SMEs in procurement activities
3. Environmental policies implemented to consider positive and negative impact to environment

For IT equipment that is the primary research focus, there is no available purchasing criteria for each product type provided by SUPC but it subscribes to DEFRA Flexible



Framework (Southern Universities Purchasing Consortium, 2016b). The Flexible Framework allows organisations to assess and monitor their sustainability progress anytime they want. This Flexible Framework is compliance with Government Buying Standard (GBS) (Southern Universities Purchasing Consortium, 2016b) mentioned in Section 2.1.4.

Under SUPC framework, ICT products are placed in two categories of National Framework. The first framework category is National Framework for the Provision of IT Related Accessories and Parts (ITRAP) cover a wide range of IT products as shown in Table 4.1. However, ITRAP does not cover laptops or notebooks. These products are covered in National Desktop and Notebook Agreement (NDNA). These National Framework compliance with EU Procurement Directives as mentioned in Section 2.1.1.

*Table 4.1: Products covered under ITRAP framework  
(Adapted from <http://www.supc.ac.uk/news/news/item/new-itrap-agreement>)*

<b>Sub-Category</b>	<b>Product example</b>
Storage media	CDs and DVDs, USB storage media, tapes, portable hard disks, memory cards, other storage devices
Components	RAM, graphics cards, processors, hard disk, internal DVD/CD drive
Displays, monitors, screens and accessories	Desktop monitors, display screens, remote controls, docking stations, stylus pen for touch screens, display mounts and brackets
Cables	Ethernet, USB, stereo jacks, HDMI, patch cables, video monitor cables, extension cables, fibre optic
Power-related accessories	Batteries, power adapters, chargers, power packs, PDUs
Peripheral accessories	Headphones, microphones, speakers, keyboard, mouse, webcams, scanners, wireless accessories and adapters, keyboard covers, voice recorders, external DVD and CD Drives, wrist rests, mouse mats, small home networking hubs
Device protection and IT security products	Laptop bags, device covers and cases, locking accessories, security cables and cages
Audio visual consumables	Replacement lamps, bulbs, wall and ceiling mounts and brackets, projector filters, tape libraries, media cards, camcorder tapes and discs, cassette tapes
Special needs assisted technology equipment	Alternative keyboard, alternative mouse, mounting solutions, note takers and literary aids, speech and hearing amplifiers, switch interface boxes

The UoB is a full member of SUPC (<http://www.supc.ac.uk/about-us/our-members/our-members>) which is one of the higher education purchasing consortia that operate throughout the UK. As a member, UoB will have the access to the list of suppliers recognised by the consortium. Any purchasing activity will be done within the national negotiated framework agreement. One of the reason most of the framework are done is because the spent has to be transparent (University IT Service Officer, personal interview, 15 February 2013). The quote taken from the interview transcript is as follows: *“The reason most frameworks are done is because the spend has to be transparent. It can’t be viewed as favouritism within Europe. So all items have to be purchased within these frameworks, that are IT based.”*

Items purchased by UoB have to be within those frameworks. However, there are specialist items not covered by any frameworks. In this case, waiver is applied where special request need to be made to purchase the item. Departments will identify the need to purchase, for example, for a laptop, and central IS then find an item that meets the need in a SUPC framework. Those contracts are negotiated either on annual or 3-year basis. Some of the factors that SUPC will be taken into account during contract negotiation are cost, supply and maintenance. In 2010, another factor is added, which is sustainability. It is now is listed as one of the element that is looked up in those contracts (University IT Service Officer, personal interview, 15 February 2013). The quote taken from the interview is as follows:

*Those contract are negotiated either on annual or 3 years basis ... and part of the contract negotiation will be the cost is one factor, the supply and maintenance on that is another factor. And in the last 3 years has come in the sustainability, the green impact as well.*

Ranges of IT product manufacturers can be chosen from the contracts. The buyers are able to choose based on their requirement (i.e. large screen, lightweight, etc.) and the

discussion will be held between buyers and IT Service officer to choose the equipment which are ‘the best value for money’.

Next, we will discuss and provide clearer understanding of why the lifetime of equipment is normally up to five years.

#### **4.5 Maintenance of Purchased Items**

One of the criteria in GBS is whole-life cost (refer Sections 2.1.4 and 2.5). One of the examples of whole-life cost that need to be considered is the maintenance of purchased items.

In UoB, all of the purchased items come together with the warranty. For example, all of the HP laptops have a 5-year warranty built in the price, Toshiba laptops have 3-year warranty with the option that can be upgraded to five years. All of the HP monitors and PC have 5-year warranty so it is guaranteed that those units will be in use for five years.

A 3–5 year replacement cycle is recommended in UoB, and the reason for that is just the right that the computer technology is moving on. The machines are expected to be powerful enough to be used within those time frames. Furthermore, the problem to get spare parts after 5 years is not easy. Another thing to look at is software because it is one of the driving aspects. The machine that is bought five years ago would not necessarily be able to run the software that is released this year. Maybe it is not powerful enough or does not have the right architecture to do so. However, it is subject to interpretation of people on sustainability itself. Lengthening the replacement cycle should reduce carbon consumption in making new units. But it could be that newer models would consume less electricity. Some kind of calculation is therefore needed. Getting spare parts is the key to a policy of extending product lives, and their guaranteed availability is often a sustainable procurement criterion. Designing software so that its hardware requirements are reduced

is also another issue. According to Dovers (2006), to address these conflicting sustainable criteria, there is a range of options to choose such as prior assessment of impacts, priorities and trade-offs.

There are two types of maintenance; the first one is the warranty that is purchased with the device, normally for the duration of 3–5 years. After that warranty expires, if the device is still required by the department, it can then go on the maintenance contract. The charges are passed on to the department, who pay the fees. IT equipment will be under maintenance contract for as long as they require or the parts are available. If the parts no longer available, the department should submit a report that the device is obsolete and it can no longer be maintained (University IT Service Officer, personal interview, 15 February 2013).

The warranty is supplied with devices and lasting for 3–5 years and has no extra cost. After that, it depends on the items, as to how much the annual maintenance will be. Generally it is not a large amount, because it added to a lot of devices then goes to the 3<sup>rd</sup> party maintenance provider, maybe £10 a year. It is not going to be a massive expenditure.

In the next section, the involvement of the UoB as a test centre; as part of the membership responsibility of the buying consortium for southern universities will be discussed.

#### **4.6 UoB's Contribution to Purchasing Consortia**

As a member of SUPC, the UoB is involved in measuring the products and equipment to be listed on the contract. Four or five universities are involved in doing physical testing for the equipment and other couple of universities are probably checking through the equipment while the consortium itself looking at other aspect like financial sustainability and also at the green credentials of the company as well.

The UoB was listed as one of the test centre for National Desktop Notebook Agreement (NDNA) review, so laptops of a certain specification from each of the suppliers were tested. Some of the laptop brands that had been tested were HP, Samsung, Toshiba, Dell, Sony and other brand as well. The benchmarking was done based on the same test performed on each piece of equipment and other criteria included quality of the built, quality of the case, the actual power and speed of the unit. However, all the tested equipment was meant to be similar grade of parts (e.g. motherboard, hard drive, etc.) and similar specification. In addition, the maintenance warranty of the products was also included in the test criterion. The top five brands were generally awarded the contract and listed in SUPC suppliers' list (University IT Service Officer, personal interview, 15 February 2013).

#### **4.7 Information Model**

A key objective of this research was the identification of the additional information that procurement staff would need in order to make effective sustainable product selection decisions. This would be based on recognised best practice documented in procurement literature (as touched upon in Chapter 2) and the practical insights of procurement practitioners as captured through interviews. Information model was then developed to assist decision makers to come out with the most informed decision of sustainable product. It is important to mention that even though the procurement systems will have basic purchase order systems (e.g. eFin) that hold data about purchase orders, suppliers, deliveries, invoices, payments, etc., these types of information are not considered in creating the information model as this research is more concerned about the information used in decision making (although overlaps will occur between the two [e.g. suppliers and product models]). As shown in Figure 4.2, various information sources were link

together to support sustainable procurement in order to make informed purchase decisions.

#### **4.7.1 Process of creating an information model diagram/framework**

To create an information model diagram, there are some processes that need to be done. Data were gathered from the interviews and documents (policy, guidelines, etc.) to find what data/information is needed to facilitate decision makers in making informed decisions. We highlighted all the important information needed by all the stakeholders to make purchase decision using marker pen in NVivo software, for example, suppliers' background, product model, sustainability criteria, etc. Some of the elements in the information model were mentioned in the literature review and best practice.

After we have gone through all the available data sources, it can be concluded that there are 13 types of information that needed to be considered when making sustainable procurement decisions, hence to be used to create an information model in Figure 4.2.

Procurement information model was developed to represent information architecture of sustainable procurement. In the information model, the relationships that link the information are very important because it could be used to navigate through the model to identify the types of information needed to carry out certain processes. For example, to find laptop suppliers accreditation from approved suppliers' list, buyer can navigate from *IT Product > Framework Agreement > Approved suppliers' list > Suppliers' Accreditation*.

To compare with procurement process model, the process to find laptop suppliers accreditation from approved suppliers' list is as follows (refer Section 4.2):

*Retrieve SUPC suppliers' list > choose suitable suppliers*

As stated earlier, information model consists of the information that needs to be considered for an informed decision making. In the above example the navigation of the information model showed that more detailed complex processing was needed than was indicated at the process model level.

Most of the information in information model would be internet sources, such as documents or policy that are needed to make procurement decisions. These documents or information come from many different external sources, such as international organisations, buying consortia, accreditation bodies, product manufacturers and suppliers and many more. They need to be integrated into a network of information that could facilitate procurement decisions. The roles of each entity are described in Table 4.2.





Table 4.2: Description of types of information in procurement information model

Type of information	Description	Source of idea	How to use this information	Attributes	Attributes Explanation
IT Product	This is list of IT product types such as laptop, desktop, printer, scanner, etc.	SUPC website (Southern Universities Purchasing Consortium [SUPC], 2017)	This information is used to check the list of products area in framework agreement	Product type	E.g. Laptop, Desktop, Printer
Product Manufacturer	The list of product manufacturers that can be selected by buyers.	<i>“We have a range of systems that we can get. If it is a laptop, we have a choice of two PC manufacturers and we have Apple as well”</i> (Information Service Officer, U1)	This information is used to check the list of manufacturers in framework agreement	Manufacturer’s name, Labour Standard code	Name of product manufacturer and any labour code if possible
Product Model	The list of product models available to purchase.	SUPC website (SUPC, 2017)	Refer to product model offered by suppliers under framework agreement	Model, Manufacturing year, specification	Model number, year of product is manufactured, detailed specification of product
Product Specification Guide	A set of sustainable product criteria guide provided by external organisations such as GPP (EU) and GBS (DEFRA).	<i>“One of the thing we do while we buying electric equipment is we do try to look at the whole-life costing ...”</i> (Procurement Manager, U3) Literature Review (Section 2.1.4)	This information is used as products specification	Impact area, mandatory	List of specification to meet that is mandatory/non-mandatory based on GBS

Product Certification/EcoLabel	This label is awarded by accreditation bodies to certify sustainable product criteria.	<p><i>"... paper from FSC sources which is Forestry Stewardship Commission and all of these have a different green impact, so all of those elements are taken into consideration, where possible for IT equipment for instance, we ask suppliers to consider how much is the equipment they are supplying us is made from the recycle materials and how much of the end of its life, can again be re-use or recycled."</i></p> <p>(Reprographics Manager, U1)</p> <p>Literature Review (DEFRA, 2012; European Commission, 2016a, 2016b; UNEP, 2012)</p>	This information can be used as a requirement to choose products	Certification/Ethical code of conduct, criteria, year	List of certification obtained by product e.g. ENERGY STAR®
Suppliers List	The list of suppliers outside any framework agreement, usually obtained after the process of finding potential suppliers through different means: advertisement, suppliers' directory, etc.	<p><i>"So, a few years ago I wanted a light laptop which was reasonably performance and there was nothing on a university purchasing list and there was any from the university's suppliers. So I went downstairs and more or less it was suggested to me I could make a really strong case within the budget for something I</i></p>	This information is used to select the best available suppliers	Product Area	The list of suppliers and their supplied products not under framework agreement

		<p><i>needed was could not be bought on approved list and it could be looked at. But you really got to fight and you would probably lose”</i></p> <p>SUPC website (SUPC, 2017)</p>			
Suppliers Accreditation/Criteria	A variety of accreditation given by assessing bodies to the supplier who is meeting a set of sustainable criteria (e.g. ISO 14001, Fair Trade, etc.).	<p><i>“We also look at the green credentials of the company as well.”</i></p> <p>Literature Review (Section 2.6 )</p>	This criteria can be used as a requirement for the university to choose suppliers	Certification/Ethical code of conduct, criteria, year	Any certification obtained by suppliers e.g. ISO 14001
Suppliers Appraisal	A process of weighting suppliers based on the information supplied in pre-qualification questionnaire (PQQ) and once again requested in Invitation to Tender or Invitation to Quote. Score will be given to each question and finally the score is total up to choose supplier with the highest score.	<p><i>“We got standard questionnaire we ask everybody, it talks about all sorts of standard including workers’ right, minimum wage, local environmental policies, social aspects as well”</i></p> <p>Literature Review (Section 2.3.1)</p>	The score given in PQQ is based on the answer given by the suppliers. There is a standard PQQ used across the country and score for each section is explained in the form.	E.g. financial background, sustainability practice	Suppliers’ criteria evaluated by buyers e.g. UoB
Approved Suppliers List	This list of suppliers normally belongs to a framework	<i>“It’s done through our suppliers; we don’t contact HP directly but deal with</i>	The list of suppliers that can be choose	Product area, contracted suppliers expiry date	The list of suppliers with their supplied

	agreement. The consortium which established the framework agreement has evaluated these suppliers against a set of sustainable criteria.	<i>the authorised HP suppliers. Basically they have done a contract to supply HP equipment, and they named by HP on the framework as the suppliers."</i>	from framework agreement.		product approved by SUPC
Framework Agreement	Provided by many organisations like universities buying consortia, Office of Government Commerce, NHS, etc. through collaborative procurement.	<i>"The reason most of frameworks are done is because the spend has to be transparent. It can't be viewed as favouritism within Europe. So all items has to be purchased within those frameworks that are IT based. We operate a centralised purchasing devolved budget strategy and we will purchase within those contracts."</i>	Framework agreement provided by SUPC can be used as a reference to choose suppliers.	Form of agreement, Specification of requirements, conditions of framework agreement, price & service schedule, Variations to contract term	Agreement between SUPC and suppliers for collaborative procurement
Existing contract record	The contract created for the past purchase	<i>NIL</i>	The terms and condition is very important and can be used as one of suppliers selection criteria	Form of agreement	Existing agreement between suppliers and buyers
Contract Criteria	Standard terms and conditions of the purchase contract e.g. price, delivery date, etc.	Literature Review (Section 2.3.1	The detailed information of contract that can be used for supplier selection criteria	Price, start date, period of contract, risks associated with each element in the contract	Provided by buyers to their suppliers

**IT product** in Information model refers to the type of IT equipment one wants to purchase. According to GBS criteria, Office IT equipment has nine product areas to choose: computer monitor, desktop computers, inkjet multifunctional devices, printers, laptop computers, laser multi-functional devices, laser printers, scanners and workstations. For example, if there is a request to buy a laptop, then IT product is a laptop. These lists of equipment are covered by **framework agreement**, for example, SUPC framework agreement. In framework agreement, there will be lists of suppliers that have been approved by SUPC to supply products according to their product area (**Approved Suppliers List**). To become SUPC approved suppliers, one need to fulfil the suppliers' criteria required by SUPC (**Suppliers Appraisal**). Once the suppliers awarded tender by SUPC, they will become SUPC suppliers for 4 years before the contract ended. **Suppliers Accreditation** or criteria will be one of the requirements to bid for tenders. Buyers can also review suppliers **contract criteria** made with SUPC. Sometimes, buyers will ask the suppliers for their sustainability credentials before purchasing any equipment. SUPC supports CIPS sustainability index (Chartered Institute of Procurement and Supply, 2015) and NETpositive Sustainability Management Tool to be used by the suppliers to demonstrate their sustainability credentials and initiatives to the buyers. However, **Supplier list** element in Information model is not covered by framework agreement. It is for the buyer who would like to make purchase outside the contract, where they require some equipment that is not covered by SUPC suppliers. **Existing contract record** is referred to contracts that were made in the past. In framework agreement, each product area will show the suppliers company or **product manufacturer**. This is important for the buyer to refer to the **product model** that is produced. Product model will show the specification of the equipment. This allowed the buyer to check on any certification that is granted for any specific equipment (**Product Certification**).

SUPC is using *product specification guide*, for example, GBS product criteria to choose products that meet their requirements (*Product Appraisal*).

Based on the procurement model above, it seems that the model does not consider some of the important sustainable criteria discussed in the previous chapter such as best practice, whole life cycle and risk. These are some of the important criteria that need to be integrated with procurement information model. This model will be revised to consider the mentioned criteria but it needs to be aligned with the university procurement strategy.

#### **4.8 Social Network Analysis (SNA) Diagram for Procurement Network**

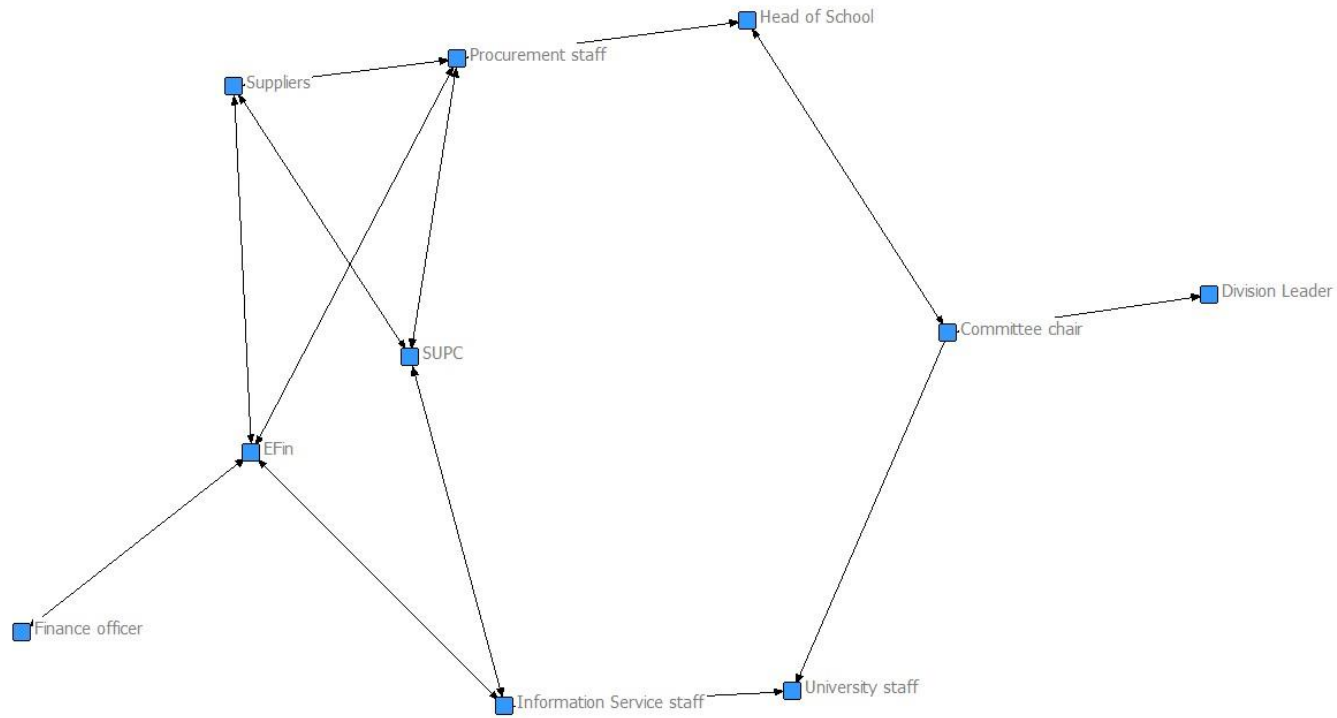
During the initial stage of this research, the procurement network was explored in order to understand the pathways of communication. During this exploratory study, we explored the relationships of UoB procurement process with other parties. We would like to see with whom procurement staff interacts within their procurement process. As explained in Chapter 3, exploratory interviews were conducted to find out who the actors in university procurement and sustainability development were and their roles. A ‘Snowballing’ technique was used to identify the actors in the network, where interviewees were asked to suggest further interviewees. Initially, we planned to use quantitative SNA techniques to identify the network of people involved in university procurement processes. However, after conducting initial content analysis on the data that we have collected, it is found that the networks that we were looking into were not homogeneous, that is that actors were not all of the same type. Most SNA techniques analyse networks assume the nodes within the network and the means of communication are all similar in nature. Instead, the networks found procurement tended to be heterogeneous where the actors were a mix of people, computer systems and

organisations, SNA techniques work best where actors are uniform, with similar characteristics and attributes (Thompson, 2003).

It was also found that the types of relationships were also varied in the procurement network. For example, some relationships involved the transfer of information while some relationships exist to 'use' the other party's policy or procurement framework. Once again, the variety of relationships in this network does not fulfil SNA requirements that type of relationship must be the same for all actors. However, SNA diagrams themselves were useful in helping understand how the actors in a network were interconnected. We did not use other functions of SNA such as measuring the 'between-ness' or centrality of the nodes or actors. SNA diagrams were generated using UCINet software.

The diagram in Figure 4.3 represents the connections among people in university procurement process. This actor network diagram was generated based on the interview data in UoB. At this stage of the research, we explored as many connections as possible relating to the procurement and tried to understand the connections and whether the connections were useful to our research or not. For example, the connection of university central procurement staff and SUPC would be different from the connection between university central procurement staff and a School or other department. The type of connection that we were looking for involved the transfer of information or knowledge needed to make informed procurement decisions, such as product criteria, green suppliers, etc.

Actors tended to have specific roles. They could come from different backgrounds and from different organisations. For example, Budget holder is a university staff at any department while Southern Universities Purchasing Consortium (SUPC) is a separate organisation that works closely with the university in procurement.



*Figure 2.3: Actor network diagram for UoB procurement process*



Table 4.3 below will explain each role in SNA diagram above. There are 10 actors that play different roles within the university. Actors come from different background, either internally or externally of the university.

*Table 4.3: Role of each actor in SNA diagram*

<b>Actor</b>	<b>Role</b>
Procurement Services	Procurement services department in university responsible for the university's procurement policy.
Head of School	A member staff in any school or department who can authorise purchase requests relating to the part of budget for which they are responsible.
Division Leader	The person who chaired the CEM School Resources Group meeting which prioritised the CEM yearly capital budget. (One of the three Division Heads in the School, who takes the role in rotation). Other Schools may have different arrangements.
Committee chair	Plan yearly capital budget of School in university (CEM): other Schools may have different arrangements
UoB staff	A staff member in any school or department who has made a request to buy something.
Information services (IS)	The assessment of any IT equipment to purchase is delegated to this department.
eFin	E-procurement system that is used as an interface between the university (buyer) and suppliers.
Finance officer	Head of the central university finance function.
Suppliers	External parties who supply goods or services.
Southern Universities Purchasing Consortium (SUPC)	Act as an intermediary between IS and the supplier in terms of negotiating framework agreements.

Having explained the role of each actor, we will now look at the types of relationship that they have with each other. Table 4.4 shows the relationship type among actors. The SNA diagram confirms the lack of a uniform type of relationship among actors. The focus here is on the actor(s) involved in this procurement network for each type of relationship.

*Table 4.4: Types of relationships between actors in SNA diagram*

<b>Actor 1</b>	<b>Actor 2</b>	<b>Type of relationship</b>
Procurement Services	eFin	Procurement staff raise requisition on eFin system
	Suppliers	Send invitation to tender
Head of School	Procurement Services	Request to purchase
Division Leader	Committee Chair	Yearly school budget planning
Committee Chair	Head of School	Send prioritised list of purchase needs to budget holder
Committee Chair	Division Leader	Contributes to list of purchase needs with purchase requests from Buying staff
UoB staff	Committee chair	Send purchase request
Information services	UoB staff	The people with the technical expertise to advise on best buy
	eFin	Send authorised requisition
eFin	Suppliers	Send purchase order
Finance officer	eFin	Authorise requisition
Suppliers	eFin	Receive purchase order
	Procurement Services	Submit tender form/response to any request from procurement

From the constructed actor network diagram above, it seems that it has contributed to a clear understanding of the communication flow of the UoB procurement process. Even though other techniques can be used, such as the data flow diagram, it could be argued that not all relationships can be adequately portrayed in terms of formal data flows. Traditional techniques normally use attributes of people such as age, gender, occupation, etc. to define social structure compared to SNA that views the ties or relationship between two or more people, organisations or institutions as an essential units of analysis (Wetherell, 1998). For example, the Head of School might have many informal discussions with various people who are in agreement with the School purchases list. In terms of the research context, this diagram could help in identifying the relevant information that flows between actors based on the types of relationship listed in Table 4.4, for example, the link/relationship between IS and buyers that discuss on the best buy.

## 4.9 Scenario of Procurement Process

One way of checking the usefulness of the procurement information model was by examining how it would support specific purchase decisions in realistic scenarios. In this section, a scenario to purchase a laptop was constructed to demonstrate the validity of the information model. This was presented as several scenarios in order to describe processes involved in detail (do Prado Leite, Hadad, Doorn, & Kaplan, 2000). The following scenarios describe a university lecturer requesting the purchase of a laptop.

### **SCENARIO 1: Information Services (IS) officer would like to identify the list of laptops that meet sustainable criteria**

An Information Services officer in the university would like to identify the list of laptops that meet sustainable criteria so that it can be a useful guideline to any staff who would like to purchase the laptop in the future. She can refer to Framework Agreement provided by SUPC in its website to find the list of product that she needs. He can choose National Desktop and Notebook Agreement (NDNA) framework agreement to find the list of approved suppliers for laptop. Contracts and other information of the suppliers on the website is IP protected and can only be accessed by authorised users (members and suppliers).

#### ***Explanation of scenario in procurement information model***

As the scenario describes, IS officer would like to identify the list of laptops that meet sustainable criteria. In the information model the following steps were performed:

1. ***IT Product*** is selected, in this case, the laptop.
2. Given the IT product, she needs to find the National Desktop and Notebook Agreement (NDNA) for laptops (***Framework Agreement***).
3. ***Approved suppliers list*** will be displayed.

4. From the approved suppliers list, she is able to see the name of the suppliers and the list of laptops brand (*Product Manufacturer*) that is available, for example, Toshiba, Lenovo, etc.
5. She can choose to view any suppliers and their product in details (*Product Model, Product Certification, Product Specification, Contracts Criteria*) and come out with the list of laptops that meet sustainable criteria for future reference.

### **SCENARIO 2: A lecturer requests to purchase a generic laptop**

A lecturer wishes to purchase a new laptop so that she can easily present classes and conduct research from different locations around the university campus. She has some specific criteria she would like her laptop to have which is energy efficient but does not know what model would suit her best.

The purchase request is sent to IS and she can request the list of approved suppliers to see their laptop models. The IS team asks the lecturer for her specific requirements, which is that the laptop is energy efficient. The IS team look at the framework agreements between the university and suppliers to see if a laptop provider is included. Several framework agreements are in existence with current suppliers.

If more than one supplier meets Sally's requirements, then a mini-tender is required by the university between the suppliers. Mini-tender or mini competition happens when the procurement team invite suppliers to provide a quotation including a request to suppliers to provide information such as suppliers' background, financial background, sustainability practices, etc. (Procurement Manager U4, personal interview, March 2014). Each of the questions carries certain amount of score. When the quotations are received by the procurement team, these are assessed and scored. The supplier with the highest score will be

awarded the contract. The purchase request is sent to the supplier. Sally receives an email stating her request has been approved and is told what laptop has been ordered.

### ***Explanation of scenario in the information model***

As the scenario describes, Sally wishes to purchase a laptop. Navigating the information model, the following steps were performed:

1. ***IT Product*** is selected, in this case, the laptop.
2. Given the IT product, she needs to find the National Desktop and Notebook Agreement (NDNA) for laptops (***Framework Agreement***).
3. ***Approved suppliers list*** will be displayed.
4. From the approved suppliers list, she is able to see the name of the suppliers and the list of laptops brand (***Product Manufacturer***) that is available, for example, Toshiba, Lenovo, etc.
5. She can choose to view any suppliers and their product in details (***Product Model, Product Certification, Product Specification, Contracts Criteria***)
6. Suppliers will be evaluated through the process of mini tenders, where all the criteria of suppliers will be given score and any accreditation they have will be an added advantage for them.
7. The supplier with the highest score will receive call-off contract (because Sally's requirements are very specified). Each question is given the range of score where it needs to be sum up at the end of the evaluation.

Table 4.5 is the matrix of information model and above scenarios. This is to validate the information model and to prove that the process of procurement is supported by the procurement information model. It shows what entities are involved in each of the scenario.

Table 4.5: Mapping scenarios with information model

Scenario	Entities												
	IT Product	Product Manufacturer	Product Model	Product Certification	Product Appraisal	Product Specification Guide	Suppliers List	Approved Suppliers List	Framework Agreement	Suppliers Appraisal	Suppliers Accreditation	Existing contract record	Contract Criteria
1	x	X	x	x	x	x		x	x				x
2	x	X	x	x	x	x		x	x	x	x	x	

#### **4.10 Chapter Summary**

The procurement information model based on the results of content analysis shows the importance of linking together related information to support effective procurement decision making. Information comes from internal and external sources of the organisation, hence the large number of potential information sources. This makes it impracticable to store all of the information in a database in order to support procurement decision making. The SNA diagrams were used identify the actors involved in procurement and the flows of information between them. In the next chapter, we will see how SNA diagrams could be used to identify the context domain for goal modelling.



## **UK UNIVERSITIES**

### **5.0 Overview of Chapter**

In this section, it represents the interviews protocol that was conducted in other UK universities for data collection. As noted above, procurement managers at a sample of other universities were also interviewed. They were asked about the process of sustainable IT procurement in their university, starting from when the request is received from the staff. The description of types of information needed and what type of information available for them to make a decision to place purchase orders were elicited during the interview. These data were needed to establish how typical the UoB procurement policies and processes of the HE sector, and to identify possible best practices.

While collecting data from different universities to explore and investigate their procurement practices, a common thread that emerged was the role in university sustainable procurement played by university purchasing consortia such as the Southern Universities Purchasing Consortium (SUPC), a representative of which was also interviewed. Since buying consortia play a part in universities' procurement processes, the interview protocol was extended to capture information related to framework agreement and suppliers. Information related to products such as criteria selection was also captured.

Public procurement in UK implements EU directives (Office of Government Commerce, 2008), so framework agreements established by buying consortia must be compliant with EU public procurement regulations (HM Treasury, 2009). By negotiating collectively with suppliers (through a consortium) to sign up to framework agreement, universities can buy discounted products from suppliers. A wide range of products and

services are listed in framework agreements, from IT to business travel, etc. Although framework agreements available covered a wide range of products, but we narrowed down the scope to only IT products. Section 5.1 that follows explains how we collect data for this research.

## **5.1 Data Collection: Contextual Information**

Besides interviews, documents related to sustainable procurement such as sustainable procurement policy and university's buyers' guide was also collected. These documents were accessed via the internet using search engine. Government documents such as EU and UK legislation (Ashurst LLP, 2012; UK Crown Commercial Service, 2016), carbon reduction initiative from HEFCE (Higher Education Funding Council for England [HEFCE], 2010b) and sustainable procurement guide from DEFRA (2013) were among of the sources that we used. The use of multiple sources of data could support data triangulation where the exploration of phenomenon is done from multiple perspectives and could help to strengthen the findings and enhance the quality of the research (Baxter & Jack, 2008). These documents were then copied into NVivo 10 to be coded along with interview data. Data analysis was then performed as discuss in Section 3.6.

### **5.1.1 Interview design**

As explained in Chapter 3 (Section 3.3 and 3.4), a series of interview were conducted in UoB and other UK universities (see list in Section 3.4). Semi-structured interviews were conducted in 4 phases: 1) initial phase in UoB 2) exploring UoB as a case study 3) Other UK universities and 4) Validation of procurement strategy implementation in UoB (this stage will be discussed in detail in Chapter 6).

The interview questions were open-ended because we wanted the interviewees to share their procurement experience in the universities. During the first phase of interviews, the questions were design to cope with the general topic of sustainable procurement with the staff member of UoB. Two sets of interview questions were designed to cope with two different network in UoB namely procurement network and sustainability network. The sample of interview protocol can be found in Appendix A – Interview protocol for procurement network and Appendix B – Interview Protocol for Sustainability network in UoB.

The second phase of interview was to explore UoB as a case study. Interview questions changed and were focused on the procurement process, influenced by the findings of the previous interviews in the first phase. The sample of interview protocol can be found in Appendix C – Interview Protocol for UoB. The same interview protocol in Appendix C was used for the interviews with the key procurement staff in other UK universities.

## **5.2 Commonalities of Procurement Practices in UoB and Other UK Universities**

From the level of the procurement process flows discussed in Section 4.2, similarities are apparent among UK universities. The universities approached in the UK are listed in Section 3.4.

The UK universities seemed generally to have a complex procurement process with a devolved budget strategy where individual schools and departments were allocated their own budgets and were able to choose how to spend them. When a request was made to purchase IT products, the request was passed to the central IT service as they were regarded as the IT procurement experts in the university. Generally IT services would then choose the precise products from a list of approved suppliers that have established

framework agreements with buying consortia such as Southern Universities Purchasing Consortium (SUPC) (James & Hopkinson, 2009).

The selection of suppliers in SUPC list may not involve identifying green suppliers. Because of that, some universities ask additional questions about sustainability to be answered by the suppliers during the selection process (Barry Chapman, personal interview, March 2014). However, buying consortia (e.g. SUPC) are encouraged to use GBS for product specifications and GBS used established measurements like ENERGY STAR<sup>®</sup> to assess product requirements, such as energy performance requirements. The fact the list of suppliers approved by buying consortia only caters for generic requirements is justified on the grounds that not all HE institutions have the same level of sustainability requirements. So to choose the suppliers conforming to their own requirements as stated in their university buying guidelines, additional assessment may need to be carried out by an individual university. The problem to deal with different selection criteria of different universities can be addressed by converting the assessment result into common measures, for example, score is given to each requirement and suppliers with the highest total score will be selected. This is done by individual universities so UoB might allocate a different score for example than Portsmouth. The process of selecting the most sustainable products and suppliers could be simplified with the support of an appropriate information infrastructure. The procurement information model (Figure 4.2) would provide a rough idea to the system designer so a system could be designed to guide the decision maker to the information needed.

University IT services were delegating the responsibility for identifying the product selection criteria (including those relating to sustainability) and selecting IT products based on criteria to buying consortia. This would be based on the assumption that the consortia had already assessed whether their suppliers offered sustainable products.

The UoB sustainable procurement is partly based on their being a ‘buyers’ community’ where people swap information about best sustainability purchases. In reality, the tendency is to black-box and delegate sustainable procurement issues. Delegating the responsibility to other people without knowing the actual process that will be carried out is known as ‘black-boxing’ (Hughes et al., 2014).

While the procurement practices were generally similar, some differences were evident. The use of differing IT platforms to support procurement was one example. Marketplaces systems such as GeM and Parabilis acted as virtual places in which buyers could search for products, suppliers and framework agreements. They also enabled buyers to request and view quotations from the approved suppliers. Orders could then be placed electronically with the selected suppliers. Marketplace systems shared these basic functions with differing additional features.

A key constraint was that the feature that enabled buyers to place orders directly with the suppliers only functioned if both parties were using or were registered with the same marketplace system. One such marketplace that allows purchases directly from suppliers is GeM (<http://www.gem.ac.uk/>). GeM is a marketplace associated with purchasing consortia for UK Higher Education such as Southern Universities Purchasing Consortium (SUPC), London Universities Purchasing Consortium (LUPC) and others. All institutions in UK who were members of any UK Higher Education purchasing consortia might have an access to the GeM portal. Although it is a common marketplace for the approved suppliers to reach their customers, some institutions still did not utilise this facility. They preferred not to use GeM because, according to them, many suppliers registered with GeM sold products that were not listed in any framework agreement. For example, companies like Insight and Nisco offered many products on their list, but a university might only want to purchase products listed in a framework agreement (IT Service Officer, University of Sussex, personal interview, March 2014). The quote from

the interview was as follows: “*Companies like Insight or Nisco ... we can only buy certain things from them*”.

Even in these cases, GeM was still usable for finding information about products, requesting quotes and using the eMarketplace. Some universities (e.g. Bournemouth University) used other marketplace to support their procurement process. An advantage of GeM was it being specially designed for universities, but other systems such as Parabilis could be used at the same time, if access to a bigger range of suppliers was required.

### **5.3 Validation of Procurement Process Model**

Following the procurement process model in Figure 4.2, four procurement processes can be identified which describe the flow of the whole process as shown in Table 5.1.

First are the processes that happened within the teaching School (between buyer, budget holder, etc.) involving the purchase decision in relation to the School budget. Once the purchase request is approved by the budget holder, it moves to the second process whereby the purchase request is raised for the respective department (i.e. IT Service) to obtain a product recommendation based on the sustainable criteria and lists of approved suppliers. The third process is to authorise the request by Information Service staff before the order can be placed with the suppliers in process four.

The reason for dividing the overall process into four main processes is to allow equivalent processes in other universities to be identified. This validation process should demonstrate that the procurement processes in University of Brighton are similar to at least one other university we approached. Table 5.1 summarises the validation of procurement processes with other universities based on interview transcripts and universities procurement policy. It shows that the procurement practice in UoB is similar to that in other universities.

Table 5.2: Processes of procurement process model: validation with other universities

Process	Text reference example
1. Individual department purchase decision	<p><i>“We operate a devolved procurement function here, which means individual school and department make their own decision what they want to buy ...”</i> – Procurement Manager, University of Reading</p>
2. Purchase Request	<p><i>“yes, we have a big system called Proactis software, and the order of IT hardware will be placed directly by IT to the processes”</i></p> <p>- Procurement Manager, University of Bristol</p>
3. Requisition Authorisation	<p><i>“Orders/contracts should be signed/authorised by the Finance &amp; Business Director or his nominee”</i></p> <p>- Procurement Policy, University of Sussex</p>
4. Raise Purchase Order	<p><i>“All orders must be on an official BluQube purchase order or must be made via an official Purchase Card transaction”</i></p> <p>- Procurement Manager, Bournemouth University</p>

Procurement process model can be used as a basic guideline to identify types of information needed to support the whole procurement process. Table 5.2 shows the type of information needed to make procurement decisions in each process.

Table 5.3: Processes of procurement process model

Processes	Type of information needed
Individual department purchase decision	IT Product Type
Purchase Request	Framework agreement, Approved suppliers' list, Suppliers accreditation, Product Model, Product Manufacturer, Existing contract record
Requisition authorisation	Suppliers Appraisal, Product Appraisal
Raise purchase order	Contract criteria

#### 5.4 Validation of Procurement Information Model

Table 5.3 attempts to match the list of information model entities with the text extracted from the interviews that refers to them. Information model was constructed based on content analysis of interview data and shows what types of information are needed when purchasing sustainable IT products.

Table 5.4: Validation of procurement information model from content analysis

Information Model Entity	Text Reference Example	No. of people mentioned	Total Count
IT Product	<p><i>"... If it is a laptop, we have a choice of two PC manufacturers ..."</i></p> <p>- Information Service Officer, U1</p>	2	2
Product Manufacturer	<p><i>"We have a range of systems that we can get. If it is a laptop, we have a choice of two PC manufacturers and we have Apple as well ..."</i></p> <p>- Information Service Officer, U1</p>	2	2
Product Model	*		



Product Specification Guide	<p><i>“... if you buy a [piece of] equipment, how much electricity it will use, what’s the whole-life costing, how were the disposal elements ...”</i></p> <p>-Procurement Manager, U3</p>	6	13
Product Certification/EcoLabel	<p><i>“... paper from FSC sources which is Forestry Stewardship Commission and all of these have a different green impact, so all of those elements are taken into consideration, where possible: for IT equipment, for instance, we ask suppliers to consider how much the equipment they are supplying us with is made from recycled materials and how much at the end of its life can again be re-used or recycled.”</i></p> <p>-Reprographics Manager, U1</p>	3	3
Suppliers List	<p><i>“So, a few years ago I wanted a light laptop with reasonable performance and there was nothing on a university purchasing list and there wasn’t any from the university’s suppliers. So I went downstairs and more or less it was suggested to me I could make a really strong case within the budget for something I needed that could not be bought on the approved list and it could be looked at. But you really have got to fight and you would probably lose.”</i></p> <p>-Former Head of Learning Environment, U1</p>	4	4
Suppliers Accreditation	<p><i>“... we’re looking for the standard that they have for manufacturer ISO 9000, sustainable credential ISO 14001 ...”</i></p> <p>Procurement Manager, U6</p>	3	3

Suppliers Appraisal	<i>“We got standard questionnaire we ask everybody, it talks about all sorts of standard including workers’ right, minimum wage, local environmental policies, social aspects as well.”</i>  -Procurement Manager, U6	4	7
Approved Suppliers List	<i>“It's done through our suppliers; we don't contact HP directly but deal with the authorised HP suppliers. Basically, they have done a contract to supply HP equipment, and they name HP on the framework as the suppliers.”</i>  - Information Service Officer, U1	4	5
Framework Agreement	<i>“The reason most of frameworks are done is because the spend has to be transparent. It can't be viewed as favouritism within Europe. So all items have to be purchased within those frameworks that are IT-based. We operate a centralised purchasing-devolved budget strategy and we will purchase within those contracts.”</i>  - Information Service Officer, U1	5	11
Existing Contract	<i>NIL</i>		
Contract Criteria	<i>NIL</i>		

Notes: \*The Product Model entity is generic and was not mentioned specifically in the interview transcripts as the whole interview was already discussing IT procurement. The Existing Contract entity was not mentioned specifically in the interviews but any similar purchase made in the future was considered as an Existing Contract. Contract Criteria were not discussed in detail during the interviews.

#### **5.4.1 Best Practice: Chartered Institute of Purchasing and Supply (CIPS)**

The Chartered Institute of Purchasing and Supply (CIPS) assist all type of organisations in their procurement and supply chain management to develop high

standards in industry. CIPS is the leading community in procurement and supply chain in UK with access to various resources such as professional knowledge on procurement. Thus, best practice recommended by CIPS is widely recognised. The procurement cycle recommended as best practice by CIPS is discussed below.

1) Identify product risks

The possible risks associated with buying the product must be evaluated before planning the buying process (Barry Chapman, personal interview, March 2014). The degree of risk associated with a product type will be amplified by the volume of purchases that it attracts. The greater the risks and purchase volumes, the more rigorous the supplier and product selection process needs to be. Ideally risk evaluation is done on a periodical basis (say, once in every 3-4 months) by central procurement staff to make sure that necessary steps will be taken prior to purchasing any high risk products (UNEP, 2012). A list of high risk product area can be shared with the buyers to make them aware of the need for more or less rigorous purchase decision making.

An organisation may rely on outside authorities for guidance about purchasing selection criteria. For example, ICT equipment such as computers, monitors and imaging equipment can use GBS selection criteria.

Supply chain issues could possibly lead to risks with sustainable products. Oxfam's product risk assessment assesses product and suppliers (Alder & Gooch, 2013). For example, if the suppliers do not meet the ethical standards, then it could lead to the use of child labour to produce the product. Supply chain issues can be divided into three types: economic,

environmental and social. Some examples for each category are listed as follows:

- 1) economic: bribery, corruption, etc.
- 2) environmental: energy efficiency, carbon emissions, etc.
- 3) social: child labour, discrimination, etc.

Many approaches can be used to prioritise products and, in this, supplier selection is crucial (BITC, 2009). One should assess the suppliers' willingness to follow ethical standards (Alder & Gooch, 2013).

Priorities are important. In order to prioritise, key driver need to be identified. For example, matrix of high reputational risk of products and relative importance of products to the organisation can be mapped to assess reputation as the key driver (BITC, 2009). Some of the approaches available are: 1) risk against procurement expenditure (Alder & Gooch, 2013; UNEP, 2012) 2) risk against scope for improvement (Alder & Gooch, 2013; UNEP, 2012) and 3) scope for improvement against market influence (UNEP, 2012).

Based on the example by the energy supplier Centrica, risk analysis is based on procurement expenditure as shown in Figure 5.1. Centrica evaluate risk based on the likelihood of non-compliance versus how important product area to their organisation. For the second approach, high risk could encourage better practice for existing suppliers, or choose new suppliers.

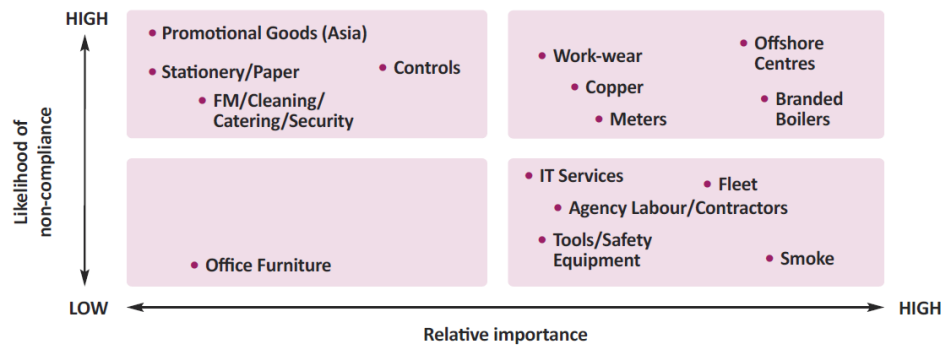


Figure 5.1: Centrica's risk analysis  
 Source: Adapted from Alder and Gooch (2013)

2) Identify general selection criteria for a product to purchase

The process of selecting a product to purchase has become more complicated in sustainable procurement process because the selection criteria will need to be based on both sustainability and other criteria such as cost and fit to purpose. A checklist produced by the United Nations Environment Programme (UNEP) (Tepper et al., 2008) is very useful. It divided into sections that include products specifications, evaluation criteria, social criteria and contracts related criteria. Each section specifies the requirements of products and the name of certification bodies that verified each specification (i.e. ENERGY STAR®, TCO Development, Nordic Swan, etc.). By doing so, the process of assessing the products to meet certain criterion can be delegated to the certification bodies without the need of the buyer to do so. For example, to buy an energy efficient monitor, one needs to find the monitor with ENERGY STAR® label.

The completed checklist will be evaluated by giving weights/score for each criterion. However, some criteria are mandatory; that is, they have to satisfied and, if not, the product is rejected, regardless of how good it might be in other ways. Many tools are available to benchmark the

equipment we want to buy in terms of their carbon emissions, etc. For example, the tool that is provided by ENERGY STAR<sup>®</sup> could measure and track the energy use and greenhouse gas emission in the building. A score between 1 and 100 will be given based on the assessment.

The product with the highest total score based on the checklist indicates that it is the most sustainable compared to other products in the list. Then, the product's specifications must be included in Invitation to Quote (ITQ) or Invitation to Tender (ITT) depending on the purchase value, so potential suppliers will get the idea the type of products the buyer would consider.

### 3) Develop criteria to assess suppliers

Procurement process used to only consider about cost and other criteria not related to sustainability but now has integrated environmental criteria into supplier selection process among others and this creates problems finding suitable suppliers (Humphreys, Wong, & Chan, 2003).

Assessing suppliers is critical to make sure that the purchase process meets all the sustainable requirements. Buyer will find a supplier that is able to offer the product that meets buyer's specifications. Under EU/UK law, if the product value is less than £25,000, an invitation to quote (ITQ) has to be sent out to the identified suppliers. A list of suppliers who received ITQ will be able to see the product specifications outline by buyers and suppliers will make the best offer to fulfil those criteria. While it is important for the buyer to offer the most suitable products, they will also need to enclose any supporting documents to response to ITQ such as ISO 14001 or any other certification they have to support their bid. ISO

14001- Environment Management System is an environmental certification that provides framework for environment management best practice (Certification Europe, 2012). According to best practice, it is suggested that the buyers choose suppliers that are a member of any relevant trade association.

For purchase value more than the specified value allowed by the organisation, potential suppliers will be given pre-qualification questionnaire (PQQ) before being shortlisted to receive Invitation-to-Tender (ITT). PQQ is mandated for Central Government to ensure that consistent core questions are asked at pre-qualification stage (UK Government, 2010). In July 2014, standard core PQQ has been revised. Pre-qualification questionnaire (PQQ) is the tool used to assess suppliers. PQQ is designed by central government to be used by public sector organisations to evaluate their supplier's performance before being shortlisted to receive invitation to tender. Suppliers are given weighting from 1-5, whereby 5 is the highest weight for each element. Score will be given based on criteria such as: financial details, organisation details, etc. The sample of PQQ score guide can be referred in Appendix D. Suppliers will be evaluated based on many criteria including sustainability criteria such as financial, business capability, compliance with EU and UK procurement legislation, capacity and technical competence and many more. Alder and Gooch (2013) suggest vital supplier criteria include accreditation by independent organisations, and suppliers' ethical and sustainability standards, etc. When suppliers are selected according to the assessment criteria, this should overcome supply chain issues raised by Business in the Community (BITC) (2009).

Each section will then be evaluated and scored. Some criteria will be mandatory and if not met the supplier will be rejected. Other supplier scores will be totaled and the supplier with the highest score will be awarded the contract.

#### 4) Suppliers appraisal and selection

Any purchase request that is not listed under any framework agreement will need to find new potential suppliers. Any supporting information related to suppliers will be requested in ITQ or ITT document to submit certification to a standard such as ISO 14001 standard. Suppliers who are able to demonstrate that they are meeting the product requirements specified by buyer will be prioritised. Buyer will also look at the services offered by suppliers such as maintenance, training, etc. Suppliers will try their best to get the contract by offering the best service and product to the buyer. They might show their environmental accreditation as an added value. On top of that, buyer has the responsibility to assess other inter-related elements such as the type of association the suppliers are registered to. Quotes received will be assessed by giving score for each criterion before the total score is being sum up. The supplier with the highest score and fulfilling most of the requirements will have the chance of being awarded the contract (refer Section 4.2). However, some mandatory requirements would have to be satisfied regardless of how good a supplier might be in other ways.



#### 5) Create and manage a contract

Supplier will be awarded a contract at this stage. A contract is expected to have sustainability related terms such as ethical or sustainable supply along with the basic information that includes price, start date and period of contract (Alder & Gooch, 2013). When the buyer has signed a contract with supplier, contract needs to be managed by aiming for continuous improvement of supplier. Feedback is also needed from the buyer and supplier on how to improve their performance in terms of social or environment and also to discuss on the ways of how buyer can help to facilitate improvements (Alder & Gooch, 2013).

#### 6) Sharing best practice

Buyer should share his experience of dealing with the suppliers and also the performance of the product. This practice is important to be shared across the organisation so other buyers who would like to deal with the same suppliers or purchase similar product might use this as a benchmark for better improvement. Important information such as suppliers list, framework agreement, existing contract, contract criteria and buyers assessment of products and suppliers might be useful for future reference.

Based on the procurement processes described above, it can be concluded that problems can arise when sustainability has been integrated into the processes:

- i. A wide range of selection criteria needs to be considered that are based on sustainability and other factors.

- ii. Costs to be considered now include not only the purchase price but those that will be incurred throughout the products lifetime such as operational costs of usage, maintenance and disposal cost (Clement et al., 2007).
- iii. How do we weight the selection criteria of products and suppliers?

In this section, the degree to which the proposed procurement information model reflects not just current actual practice, accepted best practice is explored. Table 5.4 gives an overview of the results of a gap analysis conducted to assess the degree to which the procurement information model reflected best practice, as well as current actual practice. The first column lists the steps of procurement cycle and the second column discuss about the procurement Best Practice. Then, the third column highlighted the procurement practices in UK universities. The fourth column mapped best practice with UoB procurement process model (refer Section 4.2) and the final column discuss the information model. Most of the best practice was taken from the Chartered Institute of Purchasing and Supply (CIPS) guidelines (Alder & Gooch, 2013) discussed in Section 5.4.1, which pays particular attention to the ethical and social aspects of sustainability. This includes the seven steps of procurement that need to be considered as suggested by CIPS.

It was noted that CIPS guidelines stress that risk assessment is needed to prioritise the amount of scrutiny applied to the product/suppliers in order to avoid unacceptable risk. At least some universities are currently addressing this issue by prioritising products according to the spend value.

*“We can group common products and give questions based on risks – for example fossil fuels, or any cleaning products for example”*  
(Procurement Manager U4, personal interview, March 2014).

The potential benefits of sustainable procurement (such as carbon reduction) are likely to be highest where the spend value (and thus volume of purchases) is high. As well as high volume, assessing risk is also important to avoid wasting resources on unnecessary action. IT procurement is one of the largest spend areas (Procurement Manager U4, personal interview, March 2014), thus prioritising the purchase of products that consume low energy (for example) might improve the environmental impact. The buyer or other procurement decision maker should be aware of the products and suppliers with high risks.

Sustainability issues related to products' production process need to be considered, for example, products that are made of sustainable material should be chosen as well as its packaging and delivery process. The procurement people need to be well versed in the products they want to purchase – they need to have background information about the product (i.e. product manufacturer). An understanding of the products needs to be developed not only in terms of environmental and economic but also the ethical, such as Fair Trade credentials and Labour Standards codes or equivalent. In our research context, individual university cannot be expected to carry out a lot of inspection directly so they are going to have to rely on secondary sources including expert advice. The CIPS guidelines suggested that the organisation should use any products in the market that could facilitate in managing ethical and responsible practices in its supply chain. For example, the Supplier Ethical Data Exchange (SEDEX, n.d.) offers this service to suppliers and buyers.

In the third step of procurement cycle where the specifications are all in place, it is suggested to consider the standard or code of conduct. The focus of procurement cycle moves from product to supplier. In the information model

(refer Section 4.7), the few entities that are relevant to this procurement cycle are suppliers' accreditation/criteria and existing contract record.

For the next (fourth) procurement cycle, the current practice shows that the process is carried out by assessing individual suppliers where ITT and ITQ are being sent out. In the information model, this process involved suppliers' appraisal.

Then, it comes to the fifth step of procurement process when the Tenders, Quotes and other documentation have been sent in by suppliers and they are assessed. The best practice suggested to select suppliers that meet the desired standard of ethical practice or to encourage suppliers to move towards that. As the supplier has provided evidence of awareness of sustainability issues this suggests they would be willing to address the outstanding issue. Hence discussion between buyer and supplier is important to encourage issues to be addressed in the future.

For the sixth procurement cycle, it is suggested that the ethical procurement standards and target must be included in the contract criteria on top of other sustainability targets.

Finally, the last stage in the procurement process suggests to share and reward good practice. In the procurement strategy document, the plan to create a 'buying community' is to share best practice across the university but this is yet to be implemented. Sharing knowledge about products and suppliers requires the procurement specialist located either in procurement or technical support such as information services to make an assessment once they purchase the product. They are able to rate products and suppliers before being shared across the university. Best practice should be considered to be included in the information model.

Table 5.4: Comparison of CIPS best practice and current practice of sustainable procurement

Procurement Cycle (Alder & Gooch, 2013)	Best Practice - Adapted from (Alder & Gooch, 2013)	Best Practice Procurement Process in UK universities	Interview data	University Code	Mapping best practice with UoB procurement process model  (Refer Table 6.2)	Procurement Information Model
Identifying vulnerability and risk, (prioritising products)	<i>“At the end of this stage the buyer has identified the vulnerabilities in their supply chain to ethical and sustainability risk, relating to supplier or product risks, as well as found low risk or alternative sources/suppliers/products or where there is scope to improve, to avoid unacceptable risks.”</i>	In the current practice, products were prioritised according to their common area of spend. Risks were then evaluated according to the products’ importance to the organisation	<i>“We can group common products and give questions based on risks - for example fossil fuels, or any cleaning products for example”</i>	U4	Not mentioned during interview	Risks can be addressed by integrating its measure as an attribute of Product Type and suppliers list so it can be considered when decision is made.
Understanding, prioritising and dealing with risk, (in supply chains)	<i>“At the end of this stage the buyer is more aware of specific environmental, social and economic issues associated with a product’s production process and has drafted social, economic and environmental</i>	Its main focus tends to be carbon reduction. Specification of products is discussed with the ‘procurement experts’ in the university and minimum standard has been set for suppliers and products mainly in terms of whole-life costing which includes energy usage, implementation,	<i>“..encourage suppliers to develop a practical and proactive approach to Corporate Responsibility (CR)..”</i>	U3	This practice is categorised under process 2 in procurement process model	Social issue can be integrated into specification – ISO 26000

	<i>criteria for inclusion within the specification. The buyer will build systems to identify and deal with the risk of serious activity such as fraud, corruption, bribery and modern slavery, and to achieve visibility over complex and deep supply chains.”</i>	maintenance and disposal costs.				
Supplier market engagement and development of procurement plan	<i>“At the end of this stage the buyer has updated the specification and decided whether to include a standard or code. In addition, they may have identified a need for a multi-stakeholder approach. Additional time and resources should be included in the procurement plan.”</i>	Many standards and codes are considered in making the most sustainable procurement decision, including ISO 14001 (refer Section 2.1.3) or the equivalent and eco-label or the equivalent.	<i>“We look for sort of minimum requirement, we look for financial stability, a lot of time we’re looking for the standard that they have for manufacturer ISO 9000, sustainable credential ISO 14001, and if they are offering goods and services, there is another group of criteria they are working on the university structure and such ...”</i>	U6	This practice is categorised under sub-process 2 in procurement process model	Suppliers Appraisal in the model will address this
Evaluation and shortlisting of suppliers, (including pre-	<i>“At the end of this stage the buyer has shortlisted potential</i>	Potential suppliers are being assessed (ie: pre-qualification	<i>“we have a standard supplier questionnaire</i>	U5	This practice is categorised under sub-	Suppliers Appraisal in the model will address this (based

<p>qualification followed by creation of Invitation to Tender or Request for Quotation information packs)</p>	<p><i>suppliers and sent them ITT or RFQs, which explain how the bid will be assessed, and what standards the successful tenderer will need to achieve or work towards.”</i></p>	<p>questionnaire(PQQ) to ensure they are meeting minimum standard set by university before being shortlisted for Invitation to Tender (ITT)</p>	<p><i>which asked questions about financial background and through references what insurance they got in place and part of that there are questions about sustainability which is relevant to the nature of contract.”</i></p>		<p>process 3 in procurement process model</p>	<p>on PQQ for a new supplier)</p>
<p>Evaluation of quotes or offers and preferred supplier selection</p>	<p><i>“At this stage the purchaser is either selecting a supplier which is able to meet desired standard of ethical practice, or the purchaser will make it a condition of contract for the supplier to improve their practices over the life of the contract. Where a purchaser only takes small volume or small percentage from a supplier then the purchaser will identify other purchasers to work with to build a pool of suppliers who do meet desired ethical standards as part of</i></p>	<p>Offers from suppliers are being evaluated to choose the supplier. The best offer that is meeting certain standard of university sustainability practice will be chosen (ie: value for money)</p>	<p><i>“..they have to offer the most sustainable version they can..”</i></p>	<p>U6</p>	<p>This practice is categorised under sub-process 3 in procurement process model</p>	<p>Consider offer that includes ethical practice on top of other sustainability criteria. Suppliers Appraisal in the model will address this</p>

	<i>their activities in Stage 7.”</i>					
Creation of contract and performance management against contract	<i>“At the end of this stage the buyer has signed a contract with the supplier which includes sustainability and ethical procurement standards and targets. It has put in place a structured relationship oversight and review process, which aims for continuous improvement. Exit strategies, for where a supplier fails to meet basic standards, should also be considered, only after safeguards have been put in place for workers.”</i>	Sustainability targets are included in the contract.	<i>“Those contract are negotiated either on annual or 3 years basis and part of the contract negotiation will be the cost is one factor, the supply and maintenance on that is another factor. And in the last 3 years has come in the sustainability, the green impact as well so that is now effect to what is looked up in those contract..”</i>	U1	This practice is categorised under sub-process 4 in procurement process model	Ethical procurement standards and target must be included in the contract. This should be added to contract criteria in the model for continuous improvement.
Update ethical procurement programme, (share and reward good practice)	<i>“At the end of this stage the buyer has updated their procurement programme based on feedback, learning and an assessment of progress towards desired social and environmental outcomes. This</i>	Plan to instil a Buying Mentality into staff who have procurement responsibility and share best practice across university but is yet to be implemented.	<i>“We got standard questionnaire we ask everybody, it talks about all sorts of standard including workers’ right, minimum wage, local environmental policies, social aspects as well..”</i>	U3	Not applicable.	Assessment from buyers is obtained and store in appropriate repositories for future reference, in this model it is stored under Buyers’ Assessment.



	<i>information guides activities within the programme to address root causes of problems, identifying areas in which the buyer can facilitate learning across suppliers, and where reward structures both for suppliers and buyers should be adjusted.”</i>					
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## **5.5 Chapter Summary**

Data collection in other UK universities is very important to assess the commonalities of their procurement practices. As a result, it can be concluded that UoB procurement practice is very similar to other UK universities. This is shown in the validation process of procurement process model. Information model is also validated against interview data and also best practice to demonstrate that the information model is very relevant to sustainable procurement process in UK universities context. The next chapter will discuss on the UoB procurement strategic plan because the procurement system discussed is not static but subject to change according to UoB sustainable procurement plan.

## **PROCUREMENT STRATEGIC INITIATIVE AT UNIVERSITY OF BRIGHTON**

### **6.0 Overview of Chapter**

In this chapter, the University of Brighton (UoB) 2011-2015 procurement strategic plan will be discussed in detail. It is important to look at this document because it was realised that the UoB procurement system analysed in the last chapter (refer Section 4.2) was not static, but would be subject to change because of the UoB Sustainable Procurement Strategic Plan. VMOST and B-SCP approach introduced by Bleistein, Cox and Verner (2004) was used to develop a goal model based on the UoB procurement strategic plan as described in Section 6.3. The purpose of analysing this procurement strategy using VMOST goal modelling is to assess the information model explained in Section 4.7 in the light of any additional information needs implied by the strategy. The second research questions need to be addressed relating to business alignment (see Sections 1.3 and 1.4). A challenge is that the level of granularity in the goal model implied by the strategic plan may be too abstract to guide implementation without the detail of an information model expanded and modified to take account of the new needs.

Section 6.1 will discuss on UoB sustainable procurement strategy document from 2011 to 2015. The themes and structure of the document will also be discussed. In Section 6.2, the explanation on the alignment of business and IT strategies will be discussed. Then, the way sustainable procurement strategies are converted into goal model by conforming to VMOST framework is presented in Section 6.3. In Section 6.4, the application of B-SCP technique to sustainable procurement domain will be discussed. The goal model created earlier will be evaluated in Section 6.5. Then, in Section 6.6, the

relationship between SNA and B-SCP goal context is presented. Finally, Section 6.7 will discuss the relationship between B-SCP goal model and information model.

## **6.1 UoB Sustainable Procurement Strategy**

The UoB sustainable procurement strategy (2011–2015) was developed by the university's Procurement Service team to outline proposed changes in the existing procurement practices. The plan focused primarily on the *actions* to be taken to implement change, rather than on *requirements* relating to the features of the changed systems, although these could be inferred from the changes. The change actions, for example '*Review of supplier set-up process*', were the key tasks to be carried out, and the precise operational requirements identified and incorporated into a new supplier set-up process only emerged during this activity. The strategy was to be implemented by 2015.

The strategy document was originally produced to support the university carbon reduction plan as discussed in Section 1.0. The strategy was seen as a means of ensuring that procurement practices delivered the best value for the university while taking account of environmental, social and economic concerns.

### **6.1.1 Strategic themes to support sustainable procurement vision**

The vision and mission created was supported by four strategic themes: 1) governance, 2) policy, 3) process and 4) delivery.

The strategy document stated that Governance '*ensures that relevant checks and balances are in place to enable the achievement of university objectives*'.

According to BusinessDictionary, governance can be defined as *Establishment of policies, and continuous monitoring of their proper implementation, by the members of the governing body of an organisation* (BusinessDictionary, 2016).

Among other things, this means ensuring that relevant stakeholders and strategic

partners are aware of all the university procurement procedures which include the way procurement decisions are made and the responsibilities of those involved.

The second strategic theme was Policy. This theme involved the definition of principles guiding the staff when handling suppliers and making procurement decisions. It focused on managing buyers – suppliers' relationships.

Process was the third strategic theme. While Policy focused on desired outcomes, this involved the development of standard procedures and their documentation to make sure that the procurement processes achieved the desired policy outcomes efficiently and consistently. The processes involved should be *'defined and robust'*.

Finally, the fourth strategic theme was delivery. This was to ensure that the staff and stakeholders involved in procurement activities were capable of carrying out all the tasks according to the procurement guidelines.

Each theme in the strategy document has a number of actions associated with it and each the reasons for each action along with a very short description of it were provided.

## **6.2 Alignment of Business and IT Strategies**

The implementation of the procurement strategic initiative discussed above was crucial to the achievement of the vision of sustainable procurement. This initiative could be seen as one of a number of business strategies to improve organisational effectiveness. In these cases, the ability to assess the degree to which the day-to-day operations actually contributed to the achievement of the vision was important. One of the ways in which procurement and other processes could be improved is often by the more effective application of information technologies. This was particularly relevant here because, as noted above, a key driver to more sustainable procurement was the availability of more

environmental and product information when making purchasing decisions. Although there were many business changes in the strategy that were not directly it related it appeared possible and useful to apply an approach that originated in assessing the alignment of it/is strategy and desired business outcomes. This was very important in order to ensure improved business performance (Bleistein et al., 2005).

To assess whether IT/IS developments are supporting the business needs, Bleistein et al. (2005) adopted Business Rules Group (BRG) approach known as Business Motivation Models (BMM). This concept could be used to assess the alignment of means (ways of achieving things) and ends (things to achieved) (Hughes, Cox, & Akhir, 2016).

Figure 6.1 shows the concept of means and ends adapted from BRG.



Figure 6.1: Fragment of BMM  
(adapted from the Business Rules Group, 2000)

The next section discusses how the documented UoB sustainable procurement strategy can mapped to VMOST framework as described by Bleistein et al. (2005) in order to validate an information model.

### 6.3 VMOST Framework

Our work involved using UoB documents related to sustainable procurement strategy to create a goal model that conformed to the VMOST framework. The VMOST framework helped our understanding of the strategy document by categorising six key components of the strategy namely vision, mission, goals, objectives, strategies and tactics. It is also

important to mention that the concerns of this work is the change actions – set of plans needed to transform from traditional procurement system to sustainable procurement system rather than system requirements as described by Bleistein et al. (2005). Each element in the VMOST framework will be explained in the next section.

### **6.3.1 Vision and mission**

The elements of VMOST can be divided into those relating to Ends which are those things that an organisation wants to achieve and the Means by which the Ends will be achieved.

A Vision is a future desired end-state that the organisation would like to achieve (Business Rules Group, 2000). Vision is put under Ends (things the organisation wants to achieve) category.

Mission is put under Means (ways of achieving things). There are many ways by which a vision can be achieved and the chosen way (Means) to achieve Vision is known as Mission (Sondhi, 1999).

### **6.3.2 Goal**

BRM model defines goals as *'a state or condition of the enterprise to be brought about or sustained through appropriate Means'*. Goals are the conditions that need to be satisfied in order to achieve Vision.

### **6.3.3 Objective**

According to Bleistein, Cox, & Verner (2006a), objectives can be define as *'a specific and measurable statement of intent whose achievement supports a goal'*. Objectives can be measured and have specific timeline.

### **6.3.4 Strategy**

As shown in Figure 6.2, Strategies is a sub-component of the plan for the Mission and need to be executed in order to achieve Ends or Goals in particular. Since a Mission statement is a bit broad, Strategies explain how Mission can be operationalised.

### **6.3.5 Tactic**

Tactic is a specific action or task to be executed in order to implement Strategies. A Tactic is specifically designed to achieve one or more of the objectives.

The approach of mapping goal model to context domain has been used in Bleistein et al. (2006a), however, in a different context whereby they are assessing system requirements while this research is to assess the change actions. Table 6.1 shows example of VMOST extracted from UoB procurement strategy.



Table 5.1: Extracted VMOST from UoB document

<b>Vision</b>	<i>'The university meets its requirements for works, supplies, services, and utilities in a way that achieves value for money on a whole-life basis in terms of generating benefits to society and the economy, whilst minimising damage to the environment and providing for long-term financial stability'</i>
<b>Mission</b>	<i>'Sets a clear framework for procurement throughout the University for the next four years'</i> Explanation:
<b>Goal</b>	<i>'Appropriate governance arrangements'</i>
<b>Objective</b>	<i>'To ensure compliance with policy'</i>
<b>Strategy</b>	<i>'Improve scrutiny of the nature of purchases'</i>
<b>Tactics</b>	<i>'Centralise the use of procurement cards'</i>

#### 6.4 Application of B-SCP Framework to a Sustainable Procurement Domain

The real-world sustainable procurement strategy document used in this research was now decomposed into its constituent elements using VMOST framework. The approach of Bleistein et al. (2006a) which was used as an exemplar for this approach, integrated use of the VMOST framework with complementary analytical tools to capture the business context for the strategy and to capture process requirements. Bleistein et al. (2006a) referred to this suite of techniques as B-SCP (Business Strategy, Context and Process). The application of B-SCP integrated Jackson Problem Frames with to supply a contextual orientation with real-world entities. This is the basis of the contextual analysis applied into this research but with an additional technique, social network analysis diagrams, to identify context domain for goal modelling. The modification of the Jackson-based approach was justified on the grounds it envisaged a software system as the final outcome, which was not the case here.

Relevant process elements in B-SCP were mapped using Role Activity Diagrams, as will already have been seen in a previous chapter.

### 6.4.1 Requirements domains

The way that objectives, strategies and tactics were extracted from the policy document is outlined in this section. The sustainable procurement policy document contained a table identifying the activities needed for its implementation. Table 6.2 shows an example of one row from the table in the procurement strategy procurement.

*Table 6.2: Fragment from a procurement strategy document*

<b>Action</b>	<b>Theme</b>	<b>Detail</b>	<b>Reasoning</b>
Centralise the use of procurement cards	1,2,3,4	To centralise the placing of orders via cards in Procurement Services	To ensure compliance with policy

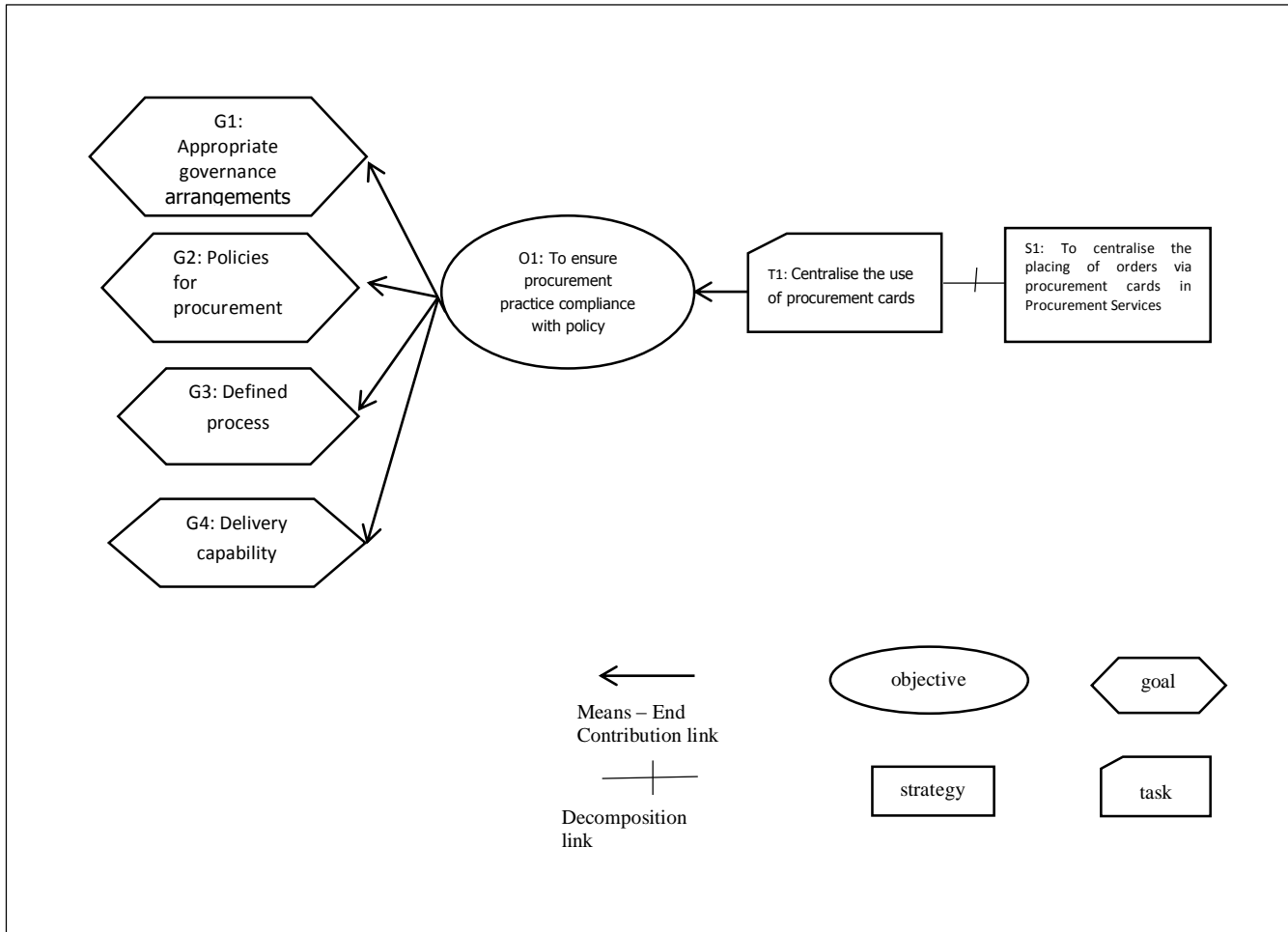


Figure 6.2: VMOST goal modelling

The wording in the Action column indicates that the row is the equivalent of a Tactic, that is, a concrete action that fulfils an Objective. In the first example, the Tactic is 'Centralise use of procurement cards'. Procurement cards are bank cards used to make payments for items without raising purchase orders. The Reasoning column has content suggesting an Objective, a desired end-point, in this case 'to ensure compliance with policy'. There is no evidence of any deliberate misuse of the cards, but the absence of a purchase order obstructs scrutiny of a proposed purchase. For example, one could not ensure that the most energy efficient IT equipment is purchased. The content of the Detail column in the first row brings in the role of the central Procurement Services department as part of a wider policy to improve scrutiny of the nature of purchases. This can be seen as a Strategy.

This demonstrates that the conversion of the content of the table in the Sustainable Procurement Policy into one that supports the VMOST framework is feasible.

Figure 6.2 above shows how the results of a goal modelling analysis can be displayed graphically.

Objective ← Tactic – Strategy

It is noticed that the goal model is slightly different than a goal model in Bleistein et al. (2006b). The way we model the goal model is based on the UoB strategy procurement document as explained above for Table 6.2. Considering the table in the document as shown in Table 6.2, the best way to draw the goal model is by mapping it back to the document because it is the best way to make procurement people understand.

Referring to Figure 6.2, clearly this is a small fragment, and a full model would be much more complicated. Cox (2015) notes the use of the graphical

representation is a powerful tool when presenting results of goal modelling analysis to clients, but are time-consuming to construct. Tables are the most convenient way of doing the initial analysis.

While relatively simple goal models may be the most effective way of communicating with key stakeholders, larger more complex models may result in information overload. The classic solution to this is a 'divide and rule' approach where a complex problem is decomposed into a number of smaller less complex sub-problems. Jackson (2001) identifies alternative ways of doing this:

a) Abstraction/decomposition. This is classic approach that divides a process into component sub-activities, each of which is expanded into more detail sub-sub-activities and so on. Thus process 'purchase goods' might be decomposed into the sub-processes 'select goods', 'ascertain price', 'make payment'. Good practice is to make each sub-component as self-contained as possible ('loose coupling').

b) Projection. This is similar to projection in relational data manipulation. Occurrences of a particular type of entity with some attribute in common are selected and isolated. The same occurrence can occur in different selections, for example, where someone has dual nationality.

The best approach depends on the particular situation. Bleistein et al. (2006a) have used an abstraction/decomposition approach which appears to reflect a hierarchy of IT/IS hardware devices. The scenario used to illustrate their method was based on the Seven-Eleven Japan system for replenishing stock in their franchised outlets. Three levels of detail related to the corporate centralised corporate servers, distributed clients in stores and the Point of Sales devices attached to the client devices. Each level looked at the processes that used one of

the three technologies. In addition there was a top level identifying the key stakeholders according to an e-business framework from Weill and Vitale (2002). In the case of our sustainable procurement scenario, a simpler approach to analysis used projection to group processes associated with each other (similar tactics/objectives). The actual domains identified in the goal model were – Overall goals, Documentation and guidelines, Contracts and spend, Suppliers and UoB Staff.

#### **6.4.2 Context domain**

It was noted above that contextual information had been represented in the Bleistein model (Bleistein et al., 2006b) in the form of a Jackson Problem Frames Context Diagrams (Jackson, 2001). It is noted that the Jackson approach is designed for the development of software solutions. Each context diagram shows a ‘machine’, (containing software) linked to other ‘domains’, including humans who interact with it.

In the case of the sustainable procurement, it was difficult to identify a central ‘machine’ that would provide the information needed to make informed buying decisions. The information needed would need to come from a range of different sources. The paradigm was that of an information infrastructure rather than an information system.

The concept of the context diagram is valid even if the role of the central machine disappeared. There was still a need to identify the actors affected by each Tactic. For example, the withdrawal of payment cards would affect departmental purchasers. The finance department would have to enforce the change, and the central purchasing department could have additional work processing payment requests. External suppliers would be affected by the change of payment method.

When building the context domain, we tried to utilise the actor network diagrams generated in Chapter 4 to identify the participants in actions and responsibilities within each the Vision, Mission, Objective, Strategic or Task components of the declared strategic plan. These would appear to provide a useful indication to what might be expected in the context domain.

Initially, it was thought that only actors from actor network diagram would be used when mapping the actors' relationships. However, when we tried to map the actors in actor network diagram with those who involved in each of the requirements, additional actors not identified in the actor network were found. There were also some actors in the actor network not mentioned in the context diagrams.

#### **6.4.1.1 Requirement Domain A**

In the top level of goal model, labelled as RA, are the set of goals that support sustainable procurement vision (V1) and are linked directly to V1 as shown in Figure 6.3.

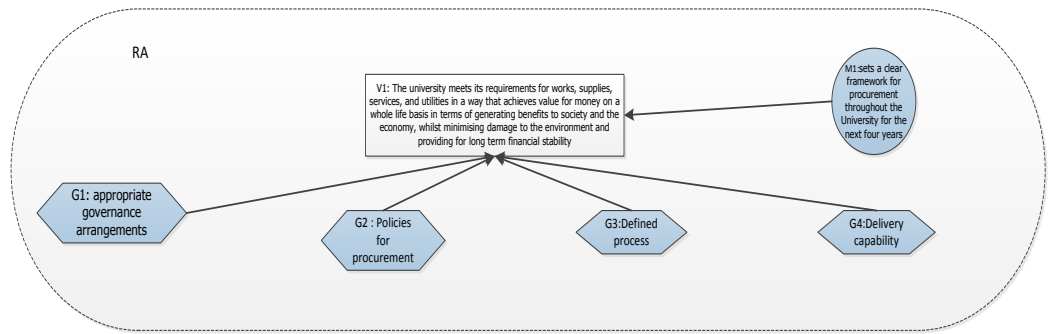


Figure 6.3: Extraction of requirement domain A

Then, RA is linked to context domain, DA, that contains the actors involved to carry out goals mentioned in RA that support V1. Other than goals, mission (M1) is also linked to V1. The sustainable procurement mission (M1) to *sets a clear framework for procurement throughout the University for the next four years* is designed to achieve the vision (V1) *The university meets its requirements for works, supplies, services, and utilities in a way that achieves value for money on a whole-life basis in terms of generating benefits to society and the economy, whilst minimising damage to the environment and providing for long term financial stability.* To implement sustainable procurement in UoB, appropriate governance needs to be in place. In this context, governance can be defined as the relationship between people who will carry out this work and UoB as a whole, for example, the relationship between procurement management and university or between procurement manager and its staff that is stated in goal (G1) *Appropriate governance arrangement*. Goal (G2) *Policies for procurement* and goal (G3) *Defined process* are supporting V1 in terms of consistent process (G2) and cost minimisation (G3). Goal (G4) *Delivery capability* is important to improve procurement capability, by increasing the capacity of staff among others.



### 6.4.1.2 Context Domain A: Overall goals

We have seen how the university was motivated to adopt sustainable procurement. In order to do that, they needed an effective procurement system. This section examines shared phenomena shared between those involved in carrying out tasks to meet goals as stated in RA. The shared phenomena are described in Table 6.3 below.

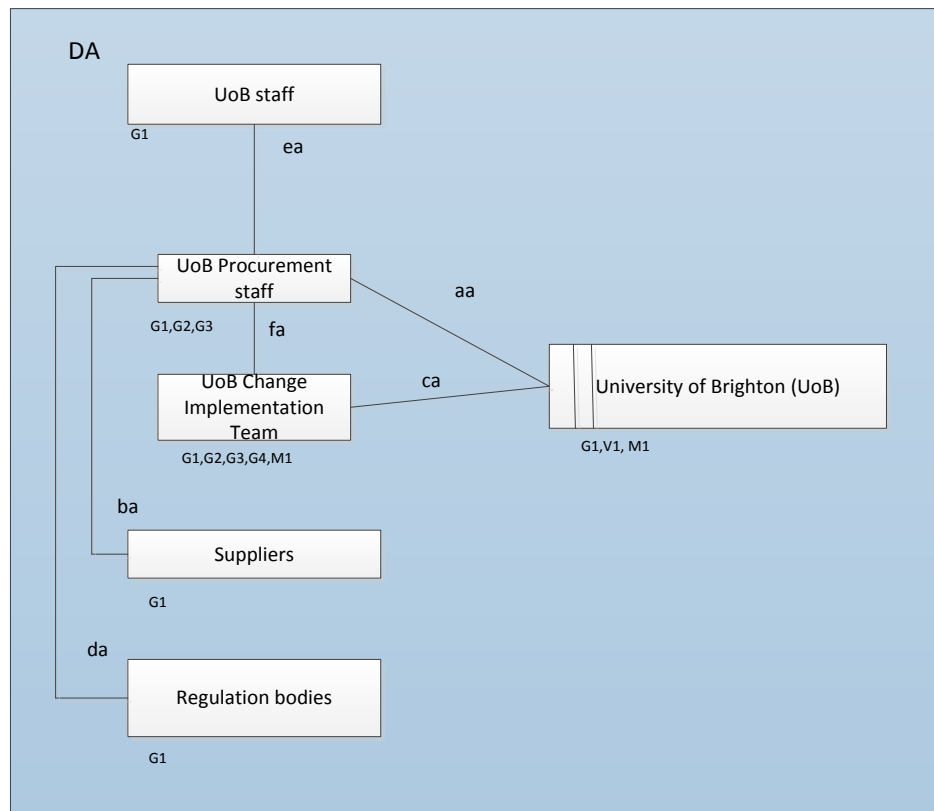


Figure 6.4: Context domain A

Table 6: Shared phenomena between context domain A

ID	Domain 1	Domain 2	Interaction ID	Shared phenomena
<b>G1</b>	UoB Procurement staff	UoB	aa	procurement process flow, relationships management protocol, resources/finance
	UoB Procurement staff	Suppliers	ba	suppliers selection procedure
	UoB change implementation team	UoB	ca	Sustainable procurement actions coordination, resources/finance
	UoB Procurement staff	Regulation bodies	da	Sustainability compliance guide
	UoB Procurement staff	UoB staff	ea	procurement process flow, UoB procurement procedures, feedbacks, communication compliance protocol, procurement guide
<b>G2</b>	UoB change implementation team	UoB Procurement	fa	procurement process flow, UoB procurement procedures, UK procurement legislation
<b>G3</b>	UoB change implementation team	UoB Procurement	fa	UoB procurement procedures, Procurement policy
<b>G4</b>	UoB change implementation team	UoB Procurement	fa	UoB procurement procedures, Procurement policy

Figure 6.4 above shows six interfaces that link context domains in DA. DA consists of people or organisations that involved carrying out tasks to meet Goals stated in RA. This is the reason why there is a relationship exists between RA and DA.

DA relates to those elements of the strategy having a bearing on governance, particularly to the allocation of the responsibilities to achieve various elements of the vision and mission of UoB. In this domain, UoB is a legal entity that represents ‘University’ and owns both vision and mission. The remainder of the DA contextual domains consists of the key players or participants responsible for tasks needed to achieve the vision.

Each interface is labelled with an alphabet from *aa*- *fa* and each interface has shared phenomena as described in Table 6.3. The tasks or activities that are referred to in DA tend to be general, for example, operational matters such as issuing purchase orders are not a key at the top levels. These may emerge at lower levels, because as we go down to the lower levels, the phenomena will become more specific and is more task-oriented.

At interface *aa*, there are few shared phenomena which are procurement process flow, relationships management protocol and resources/finance. UoB Procurement staff is responsible for ensuring that buying procedures meet university and other externally imposed requirements. Central university staff representing UoB as a legal entity will also have to confirm that procurement staff members have fulfilled their responsibilities. Other than that, UoB has the responsibility for driving through a consistent process carried out by procurement staff. Resource/finance needs to be supplied by UoB to carry out identified tactics.

The responsible domain for interface *ba* is UoB Procurement staff and suppliers. Suppliers should be able to provide products that meet the requirements required by UoB. Procurement staff needs to ensure that its relationship with suppliers is in place. This arrangement is important to provide a smooth and efficient procurement process. The link between UoB change implementation team and UoB, labelled as *ca*, is important to make sure that all actions are in place to meet UoB requirements. UoB is the responsible domain for UoB implementation team to carry out all actions as required and this includes finance.

At interface *da*, Regulation bodies have link with UoB procurement staff. UoB procurement staff needs to ensure that UoB procurement practice complies with regulatory bodies. In this context, UoB procurement staff depends on regulation bodies to verify sustainable requirements of products.

Interface *ea* between UoB procurement staff and UoB staff is responsible to ensure the best sustainable solutions. At the same time, UoB staff may receive and give feedback to UoB Procurement staff. In this context, UoB staff is defined as university staff members who are authorised to place orders subject to authorisation by central procurement staff.

Finally, at interface *fa*, UoB change implementation team is the responsible domain who shares procurement process flow with UoB Procurement staff.

#### **6.4.1.3 Requirement Set B**

Ten objectives are involved in this group as shown in Figure 6.5. Most of the objectives are about producing important documentations and guidelines to be used by UoB staff with procurement responsibilities and also suppliers, task delegations, process review, etc. These actions in the change plan need to be in place before the whole sustainable procurement system can be implemented.

The objectives, tactics and strategies in this group support goals in RA. Some of them may support only one goal and some may support more than one goal.

The objectives that belong to this group are (O1) *To ensure procurement practice compliance with policy* which is executed by (T1) *Centralise the use of procurement cards for strategy* (S1) *To centralise the placing of orders via procurement cards in Procurement Services.*

Objective (O2) *To give staff readymade tools to assist with their procurement role* that is carried out by (T2) *Develop standard documentation.*

Another objective is (O13) *To ensure financial regulations are fit for purpose and in line with best practice* which is supported by (T14) *Annual review of the financial handbook and financial regulations.* This is for strategy (S14) *Review the financial regulations relating to procurement.*

(O25) *To ensure that relevant risks are considered as part of the procurement process to ensure that contracts are fit for purpose* is carried out by (T27) *Implement Pre tender Risk appraisals for all large/strategic contracts* to fulfil strategy (S27) *Develop a simple process that manages appropriate risks e.g. University objectives, whole-life cost, market approach, scope, cost, time scales, sustainability, etc.*

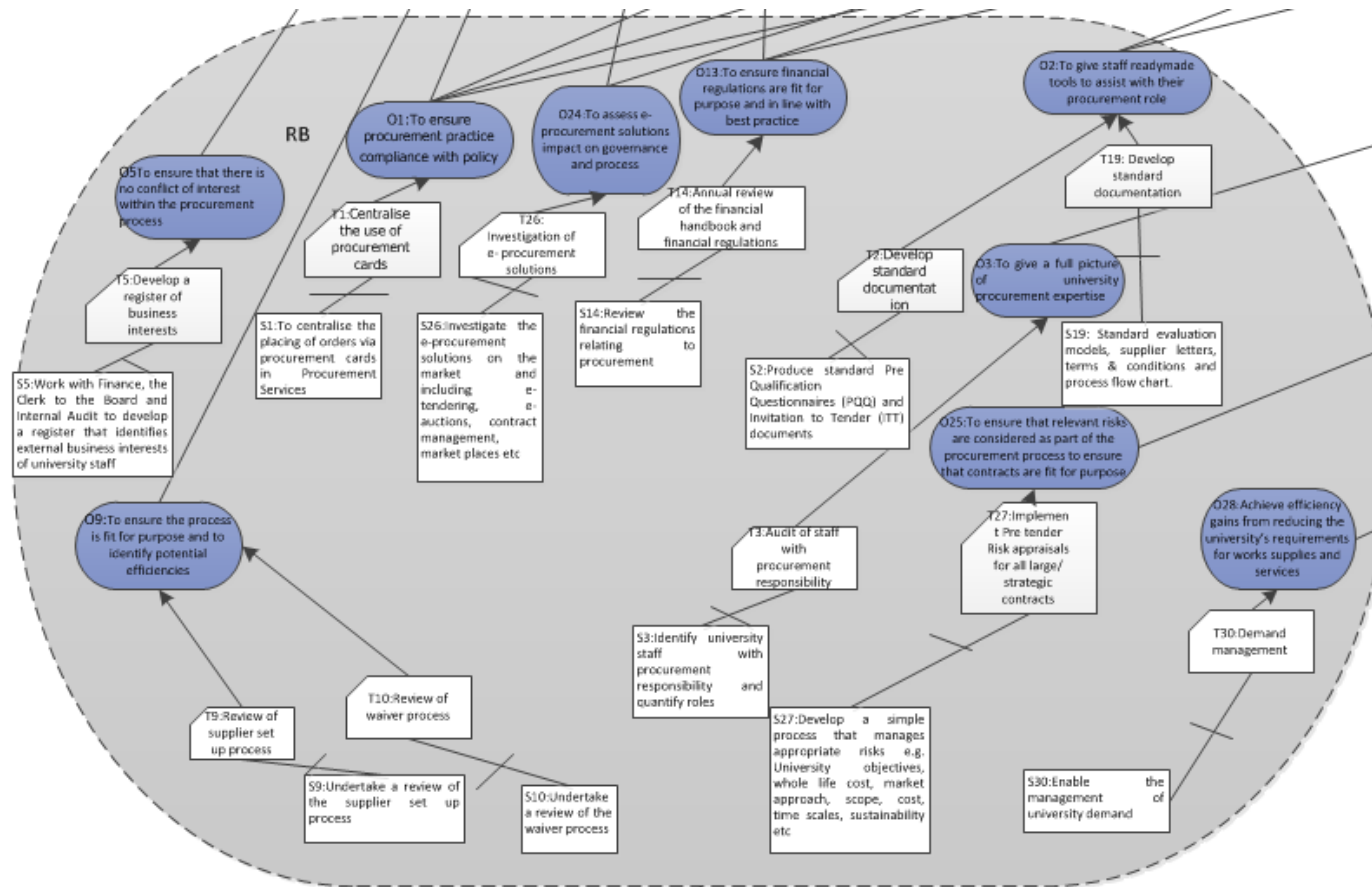


Figure 6.5: Extraction of requirement domain B

Other objective is (O3) *To give a full picture of university procurement expertise.* To meet this objective, task (T3) *Audit of staff with procurement responsibility* is carried out. The strategy for this objective is (S3) *Identify university staff with procurement responsibility and quantify roles.*

Objective (O9) *To ensure the process is fit for purpose and to identify potential efficiencies* is supported by (T9) *Review of supplier set up process* for strategy (S9) *Undertake a review of the supplier set up process.*

Objective (O5) *To ensure that there is no conflict of interest within the procurement process* will be achieved by executing task (T5) *Develop a register of business interests* for strategy (S5) *Work with Finance, the Clerk to the Board and Internal Audit to develop a register that identifies external business interests of university staff.*

Then, objective (O24) *To assess e-procurement solutions impact on governance and process* will be executed by task (T26) *Investigation of e-procurement solutions* for strategy (S26) *Investigate the e-procurement solutions on the market and including e-tendering, e-auctions, contract management, marketplaces, etc.*

Finally, objective (O28) *Achieve efficiency gains from reducing the university's requirements for works supplies and services* is carried out by task (T30) *Demand management* for (S30) *Enable the management of university demand.*

#### 6.4.1.4 Context Domain B: Documentation and guidelines

This context domain, DB shows the key players involved in supporting some of the requirements to produce documentations and guidelines to implement sustainable procurement in UoB. There are four interfaces labelled from *ab-db* identified in DB as shown in Figure 6.6.

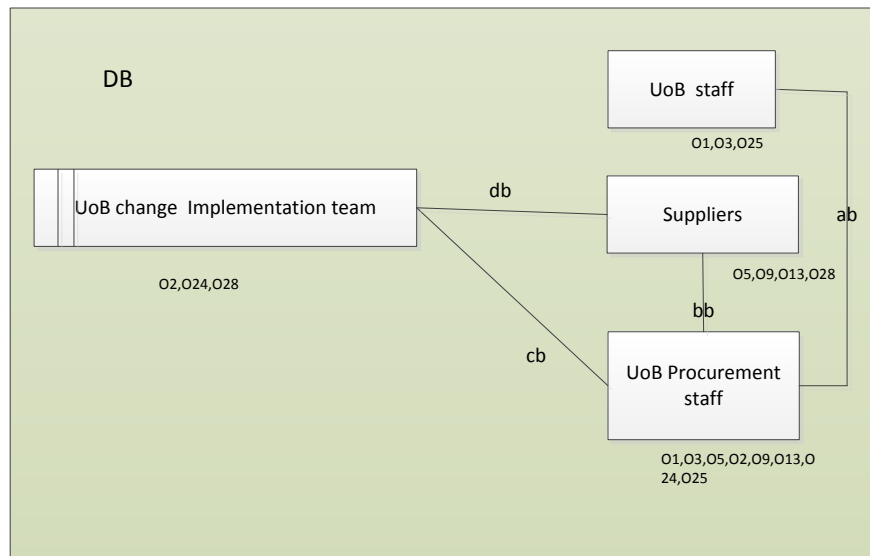


Figure 3: Context domain B



Table 7: Shared phenomena between context domain B

ID	Links to	Domain 1	Domain 2	Interaction ID	Shared phenomena
O1	G1,G2,G3,G4	UoB Procurement staff	UoB staff	ab	Procurement policy, procurement process flow
O2	G3,G4	UoB change implementation team	UoB Procurement staff	cb	Tender evaluation, contract, standard documentation, procurement policy, procurement guide
O3	G4	UoB Procurement staff	UoB staff	ab	Procurement guide, Job description
O5	G1	UoB procurement staff	UoB staff	bb	staff profile
O9	G1	UoB Procurement staff	Suppliers	bb	Supplier performance score, supplier management information, feedback
O13	G1,G3,G4	UoB Procurement staff	Suppliers	bb	Supplied product, best practice
O24	G1,G3	UoB change implementation team	UoB Procurement staff	cb	Assessment report
O25	G4	UoB procurement staff	UoB staff	ab	Procurement processes flow Procurement guide
O28	G4	UoB change implementation team	Suppliers	db	Procurement processes flow Procurement guide

The shared phenomena at interface *ab* between UoB procurement staff and UoB staff is procurement policy, procurement process flow and procurement guide. Procurement process flow is important to be shared with UoB buying staff so that they understand what is the procurement process involved so this could help them to go to the right channel when ordering any products. Same goes to procurement policy. Other shared

phenomenon is job description, which is to give UoB staff a clear picture of procurement expertise in UoB.

Another shared phenomena share at interface *bb* is between UoB procurement staff and UoB staff. Their shared phenomena consist of staff profile. This involves asking staff to declare their involvement with businesses.

Interface *cb* between UoB change implementation team and UoB procurement staff involved a few shared phenomena such as Standard contract document, procurement process flow, List of training and Assessment report.

The relationship between UoB change implementation team and suppliers, labelled as *db*, lead to the shared phenomena such as procurement processes flow and procurement guide.

#### **6.4.1.5 Requirement Set C**

Most of the requirements in group C are related to contracts and spend data. There are four objectives supported by a number of tasks to meet the strategy as shown in Figure 6.7.

The first objective is (O12) *To enable the monitoring of year on year progress of procurement activity* that is carried out by task (T13) *Develop a procurement information monitoring system*. This task and objective is carried out to achieve the dedicated strategy (S13) *Develop a system of monitoring procurement activity in the university against the KPIs*.

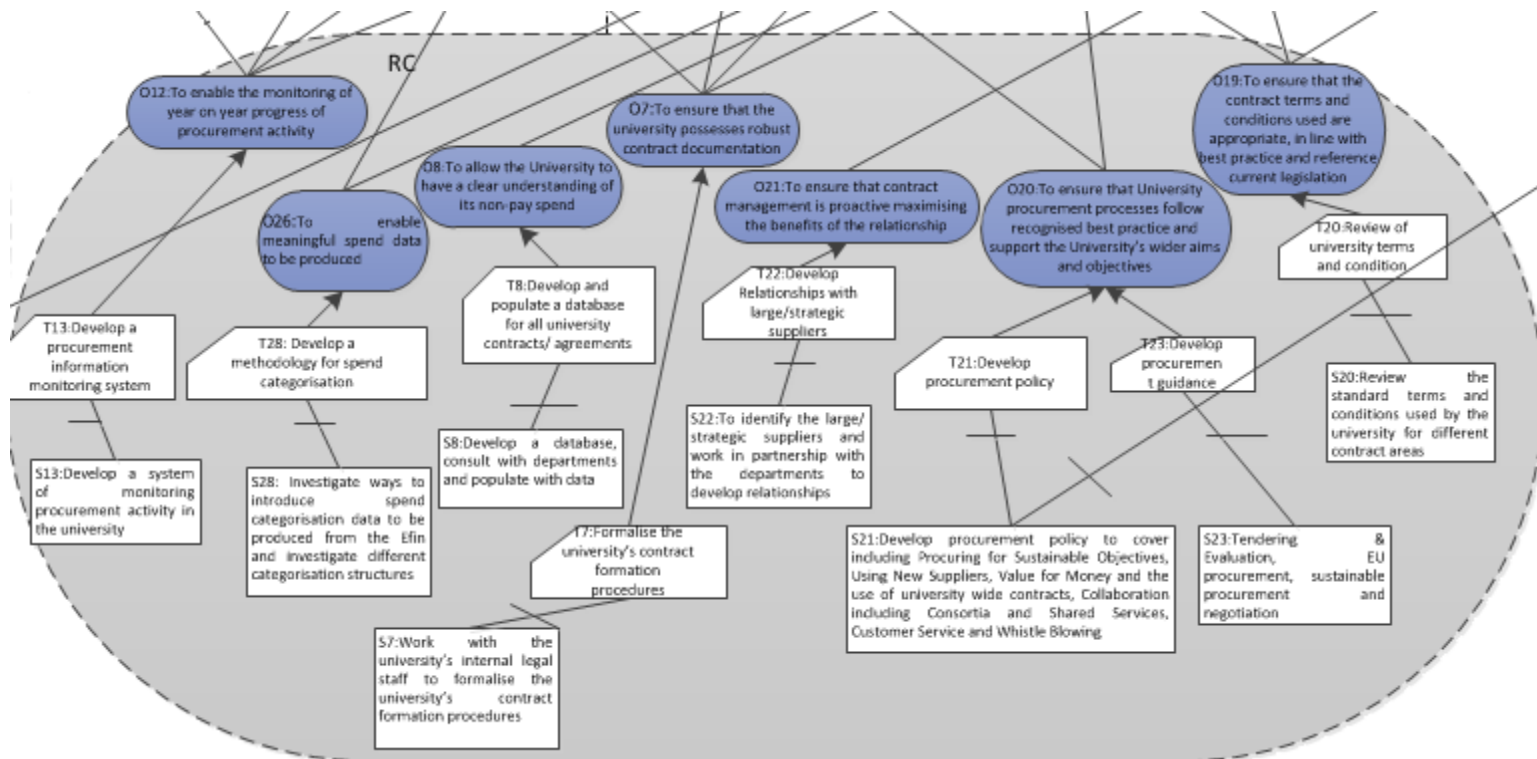


Figure 6.7: Extraction of requirement domain C

Then, the next objective, (O26) *To enable meaningful spend data to be produced* will be carried out by (T27) *Implement pre-tender risk appraisals for all large/strategic contracts*. The strategy for this objective is (S28) *Investigate ways to introduce spend categorisation data to be produced from the eFin system and investigate different categorisation structures*.

Then, (O7) *To ensure that the university processes robust contract documentation* that is carried out by (T7) *Formalise the university's contract formation procedures* for (S7) *Work with the university's internal legal staff to formalise the university's contract formation procedures*.

Objective (O8) *To allow the university to have a clear understanding of its non-pay spend* is supported by tactic (T8) *Develop and populate a database for all university contracts/agreements*. The strategy for this objective is (S8) *Develop a database, consult with departments and populate with data*.

Objective (O19) *To ensure that the contract terms and conditions used are appropriate, in line with best practice and reference current legislation* is carried out by (T20) *Review of university terms & conditions*. This is for strategy (S20) *Review the standard terms and conditions used by the university for different contract areas*.

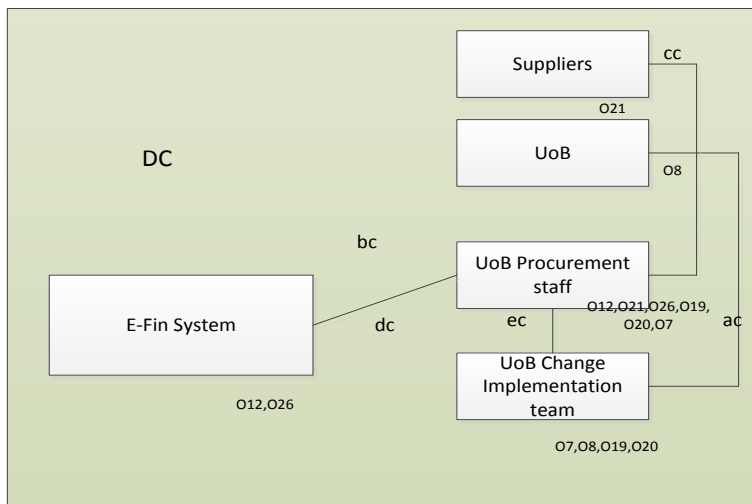
Another objective (O20) *To ensure that University procurement processes follow recognised best practice and support the University's wider aims and objectives* can be executed by (T21) *Develop procurement policy* and (T23) *Develop procurement guidance*. The strategy for this objective are (S21) *Develop procurement policy to cover including Procuring for Sustainable Objectives, Using New Suppliers, Value for*

*Money and the use of university wide contracts, Collaboration including Consortia and Shared Services, Customer Service and Whistle Blowing and (S23) Tendering & Evaluation, EU procurement, sustainable procurement and negotiation*

Finally, objective (O21) *To ensure that contract management is proactive maximising the benefits of the relationships* can be achieved by doing tactic (T22) *The strategy involved is (S22) To identify the large/strategic suppliers and work in partnership with the departments to develop relationships.*

#### **6.4.1.6 Context Domain C: Contracts and spend**

In this context domain, several lists of key players are involved in carrying out the identified strategy plan in Requirements C as shown in Figure 6.8.



*Figure 6.8: Context domain C*

Table 8: Shared phenomena between context domain C

<b>ID</b>	<b>Link to</b>	<b>Domain 1</b>	<b>Domain 2</b>	<b>Interaction ID</b>	<b>Shared phenomena</b>
<b>O7</b>	G1,G2,G3,G4	UoB change implementation team	UoB procurement staff	Ec	Standard contract document, procurement process flow
<b>O8</b>	G4	UoB change implementation team	UoB	Ac	Spend data
<b>O12</b>	G1,G2,G3,G4	UoB Procurement staff	eFin system	Bc	Procurement activity, performance, spend data
<b>O19</b>	G1,G2,G4	UoB change implementation team	UoB Procurement staff	Ec	Current legislation, best practice, contract
<b>O20</b>	G1,G2	UoB change implementation team	UoB Procurement staff	Ec	Procurement processes flow, Procurement guide, best practice
<b>O21</b>	G4	UoB Procurement staff	Suppliers	Cc	Supplier performance score, supplier management information, feedback
<b>O26</b>	G2,G4	eFin system	UoB procurement staff	Dc	Spend data report

Only five interfaces are involved in DC as mentioned in Table 6.5. The first interface labelled as *ac*, is the connection between UoB change implementation team and UoB. Another interface is labelled as *bc*, which connect eFin system and UoB procurement staff. They are working on producing meaningful spend data, so spend data report is identified as the shared phenomena. The eFin system should be able to generate the data needed to produce spend data report. The next responsible domain is UoB procurement staff that has connection with suppliers. This connection is labelled as interface *cc*, is responsible to work with suppliers in term of how to improve their relationship and to come out with the method to

choose the best suppliers that fulfil the requirements of UoB procurement team. It responsible to make sure that procurement process follows best practice in terms of suppliers' selection and contract management.

The relationship between eFin system and UoB Procurement staff is labelled as interface *dc*. The eFin system can be utilised to produce spend data report for procurement staff. Finally, the fifth interface is between UoB change implementation team with UoB Procurement staff. This relationship is labelled as *ec*. This is to ensure that procurement process and related terms and conditions are designed to follow best practices.

#### **6.4.1.7 Requirements Set D**

RD only has six objectives. Most of the objectives in this group are related to suppliers as shown in Figure 6.9.

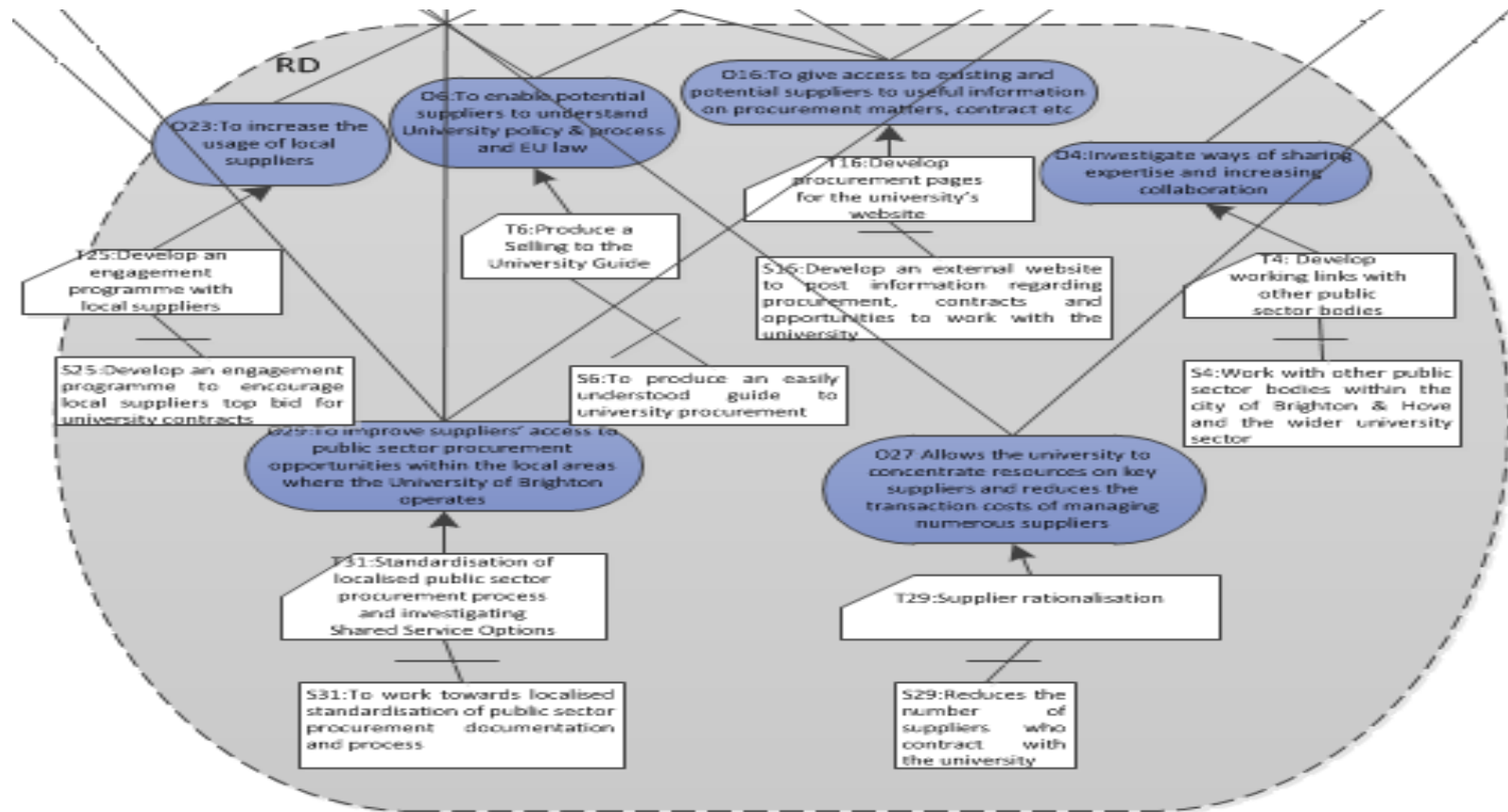


Figure 4: Extraction of requirement domain D



Many initiatives are created to improve the relationship between UoB and suppliers, for example (O16) *To give access to existing and potential suppliers to useful information on procurement matters, contract, etc.* which is carried out by (T16) *Develop procurement pages for the university's website.* Other objectives include (O23) *To increase the usage of local suppliers* that is supported by (T25) *Develop an engagement programme with local suppliers* and (O29) *To improve suppliers' access to public sector procurement opportunities within the local areas where the University of Brighton operates e.g. Brighton & Hove, Eastbourne, etc. and provide efficiency gains for the public Hastings sector bodies concerned* that is supported by (T31) *Standardisation of localised public sector procurement process and investigating Shared Service Options.* UoB needs to make sure their suppliers are aware with their procurement policy as stated in (O6) *To enable potential suppliers to understand University policy & process and EU law* and to ensure of sharing skills as in (O4) *Investigate ways of sharing expertise and increasing collaboration.* Finally, (O27) *Allows the university to concentrate resources on key suppliers and reduces the transaction costs of managing numerous suppliers* is also belongs to this group.

#### **6.4.1.8 Context Domain D: Suppliers**

Five interfaces have been identified in context domain D. They are labelled as *ae* to *ee*. Figure 6.10 shows context domain D. The relationships among the context are listed in Table 6.6.

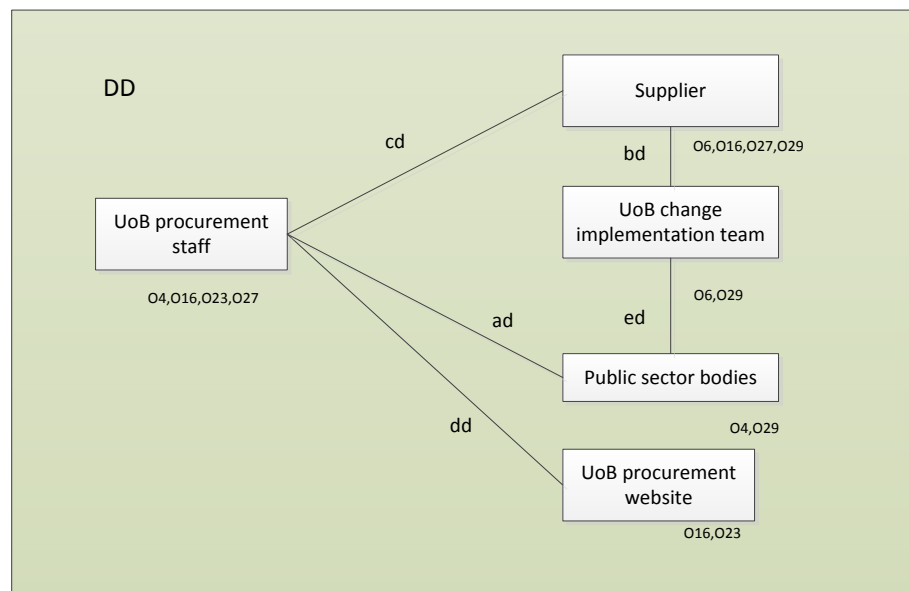


Figure 50: Context domain D

Table 9: Relationship between context domain D

ID	Links to	Domain 1	Domain 2	Interaction ID	Shared phenomena
O4	G4	UoB Procurement staff	Public sector bodies	ad	Information posting, knowledge sharing protocol
O6	G2,G4	UoB change implementation team	Suppliers	bd	University procurement policy, procurement process flow
O16	G1,G2,G4	UoB Procurement staff	Suppliers	cd	Procurement information
		UoB Procurement staff	University procurement website	dd	Information posting
O23	G2,G4	UoB Procurement staff	University procurement website	dd	Information posting
O27	G2,G4	UoB procurement staff	Suppliers	cd	Suppliers selection procedure, supplier profile
O29	G2,G3,G4	UoB change implementation team	Suppliers	bd	Contract opportunities
			Local public bodies	ed	Information sharing supplier profile (local suppliers/sustainable suppliers)

Interface *ad* between UoB procurement staff and public sector bodies to establish any collaboration links to share expertise or any related knowledge. The relationship between UoB changes the implementation

team and suppliers, *bd*, and encourages suppliers to bid for contracts and to provide a business register to avoid conflict of interest.

Interface *cd* shows that most of the criteria for this relationship, between suppliers and procurement staff, is similar to the relationship between suppliers and university website. Procurement staff is responsible in preparing all the related documents to be uploaded to the university procurement website.

UoB procurement staff will use university procurement website to expose suppliers with contract and share any useful procurement knowledge as shown by *dd*. University procurement website plays quite an important role and can be act as a platform of knowledge sharing to the suppliers. Interface *ed* is between UoB change implementation team and public sector bodies, which is looking at engagement and collaboration in terms of procurement shared service. UoB also is looking at their process and documentation that could be adopted for UoB procurement process.

#### **6.4.1.9 Requirements Set E**

RE is related to UoB and its staff, in terms of how to share information or knowledge with each other. This is shown in Figure 6.11. There are seven objectives that are going to be delivered in RE. One of the plans is trying to utilise the best means of sharing information among the staff, for example, the Staffcentral.

The first objective grouped in RE is (O10) *To give all staff an overall understanding of university procurement processes and where they can receive assistance*. This objective is carried out by doing (T10) *Review of waiver process*.

Objective (O11) *To ensure a baseline level of knowledge of procurement matters* is for strategy (S12) *Deliver training covering tendering procedures, sustainability, negotiation and EU procurement regulations* and is executed by (T12) *Deliver procurement training*.

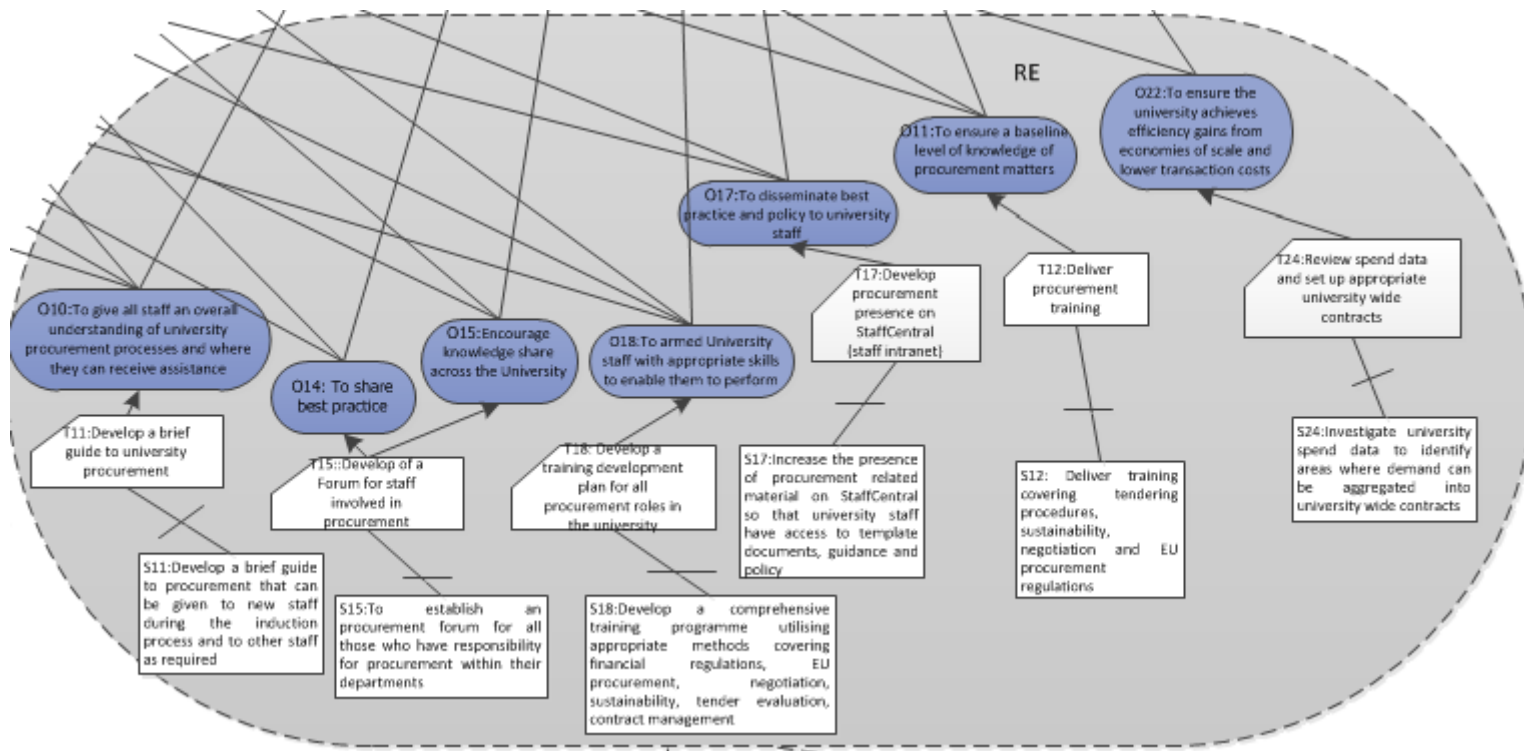


Figure 6: Extraction of requirement domain E

Then, (O14) *To share best practice* is carried out by (T15) *Development of a Forum for staff involved in procurement*. The strategy for this objective and task is (S15) *To establish an procurement forum for all those who have responsibility for procurement within their departments*. The same task is carried out to achieve another objective, (O15) *Encourage knowledge share across the University* while (O17) *To disseminate best practice and policy to university staff* will be carried out by (T17) *Develop procurement presence on StaffCentral (staff intranet)*. (O18) *To armed University staff with appropriate skills to enable them to perform* is supported by (T18) *Develop a training development plan for all procurement roles in the university*. Finally, (O22) *To ensure the university achieves efficiency gains from economies of scale and lower transaction costs* is carried out by (T24) *Review spend data and set up appropriate university wide contracts*.

#### **6.4.1.10 Context Domain DE: UoB staff**

Figure 6.12 shows context domain E, with six interfaces and five contexts. They are labelled with *ae* to *fe*.

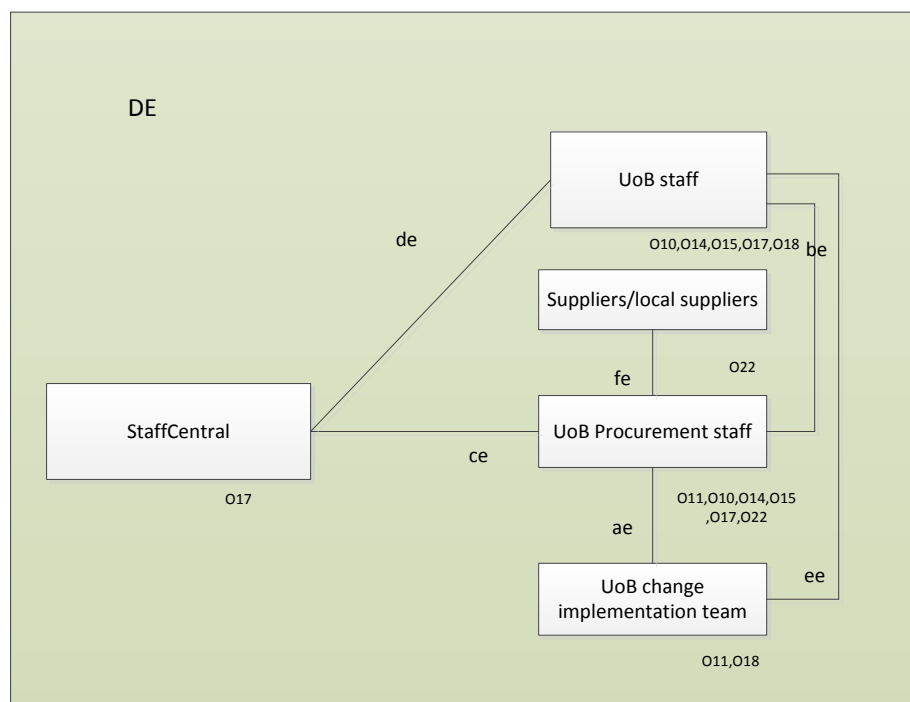


Figure 7: Context domain E

Table 10: Relationship between context domain E

ID	Links to	Domain 1	Domain 2	Interaction ID	Shared phenomena
O10	G1,G2,G3,G4	UoB Procurement staff	UoB staff	be	Procurement processes flow P4: Procurement guide
O11	G2,G3,G4	UoB change implementation team	UoB Procurement staff	ae	List of training
O14	G2,G3,G4	UoB Procurement staff	UoB staff	be	Knowledge sharing protocol
O15	G2,G3,G4	UoB Procurement staff	UoB staff	be	Knowledge sharing protocol
O17	G1,G2,G4	UoB procurement staff	StaffCentral	ce	Information posting
		StaffCentral	UoB staff	de	Best practice, university procurement policy
O18	G1,G2,G3,G4	UoB change implementation team	UoB staff	ee	List of trainings, KPI list
O22	G2,G4	UoB procurement staff	Suppliers	fe	Suppliers selection procedure, supplier profile

As we can see, this domain involved people who want to purchase items, people from procurement, people who are responsible for new change action and a computer system (StaffCentral). As listed in Table 6.7, the first connection, *ae*, is between UoB change implementation staff and UoB Procurement staff. They are expected to work on producing standard procurement documents, contracts and also to centralise the use of procurement cards. Interface *be* between UoB procurement staff and UoB staff is to encourage knowledge sharing between these two parties to ensure smooth procurement process. Interface *ce* between UoB procurement staff and StaffCentral is related to information posting to share best practice and procurement policy to UoB staff.

Interface *de* is responsible to provide any related materials on StaffCentral to enable UoB staff to have easy access on procurement information and also related documents. Finally, interface *fe* between UoB procurement staff and suppliers involved shared phenomena about supplier selection to ensure that the right suppliers is chosen.

## **6.5 Evaluation of Implemented Programme**

The evaluation of the goal model diagram was carried out after the completion of the whole goal model which coincided with the end of the implementation period of the UoB Sustainable Procurement Strategy 2011–2015, by arranging interview sessions with procurement staff in the university. Following the completion of goal model diagram, procurement staff was contacted and the interview sessions were conducted with Procurement Officer, Sustainable Procurement Officer and Head of Procurement. The appointments were set up according to their availability. This exercise was done with the key people in University of Brighton procurement. They were given the 5 years



procurement strategy produced in 2011 that has been decomposed into tabular form to ease their understanding. Each vision, mission, goal, objective, strategy and task was given an ID and grouped accordingly and there is a column to show its link – either to support other mission, goal, objective, strategy or task.

### **6.5.1 Interview Protocol**

Interview protocol was developed to evaluate the goal model representing the sustainable procurement programme and also the degree to which the programme had actually been successfully completed. As we are aware, UoB strategic documents contains the plan of actions to change the ‘current’ system to a new procurement system. The document lists a set of actions that need to be implemented in order to achieve this. The interview protocol was design to be able to capture the feedback from procurement staff regarding:

- 1) The implementation of plans according to procurement strategic document.
- 2) The discussion about problems in executing the plans.

The interview protocol was adapted from the procurement strategic document. All of the change plans were listed in a table with additional columns for the procurement staff to comment. Table in Appendix C shows the interview protocol to evaluate the goal model.

The procurement staff was able to see the plans that has been categorised according to VMOST framework. For each of the elements in the table, a column is provided to capture its status, either Implemented, Not Implemented or Work in Progress. Another column is provided for additional comments especially to obtain feedbacks on why the plan is not implemented or still in progress.

Table 6.8 shows the result of interview test in tabular form. The interviewees were asked if any of the mission, goal, objectives, strategies or tasks were implemented as planned, were not implemented or if they were still in progress. We would encourage them to share the reason for any of the plan that is not being implemented. During the interview, they were asked to describe the university's procurement process again. This is to identify if there is any additional information being used in making sustainable procurement purchase other than that has been listed in procurement information model.

For V1, it is marked as not applicable (N/A) in Table 6.8 since all the mission, goal, objective, strategy or task was carried out to support the vision. From the interview, it could be concluded that most of the strategies plan had been already implemented and some actions were still ongoing. However, some strategy plans failed for various reasons – see Section 6.5.2.2.

A number of additional information items used in making procurement decisions have been identified that were not mentioned during our data collection interviews. Thus, some amendments were required to be done to the proposed procurement information model. Some of the information sources were actually in place (e.g. procurement guide, whole-life costing document) but might not needed by the stakeholders as some of the assessment or evaluation of certain product is delegated to external parties and is treated as 'black box' (Hughes et al., 2014). For example, whole life cycle data for certain products might not be used directly by the decision makers in the procurement department.

Table 118: Result of goal model validation

ID	Description	Implemented? Y / N / WIP?	If NO, why?	Additional comments
V1	The university meets its requirements for works, supplies, services, and utilities in a way that achieves value for money on a whole-life basis in terms of generating benefits to society and the economy, whilst minimising damage to the environment and providing for long term financial stability.			
G1	Appropriate governance			
G2	Policies for procurement			
G3	Defined process			
G4	Delivery capability			
O1	To ensure procurement practice compliance with policy	WIP		It is quite difficult to ensure buyers to follow the right procurement practice/ need to order people
O2	To give staff readymade tools to assist with their procurement role	Y		Got evaluation model but need further development
O3	To give a full picture of university procurement expertise.	N	Resource issue	
O4	Investigate ways of sharing expertise and increasing collaboration	Y		
O5	To ensure that there is no conflict of interest within the procurement process.	WIP		Business interest register was created to register those who are involved in procurement and there are 75% return
O6	To enable potential suppliers to understand University policy & process and EU law	WIP		
O7	To ensure that the university possesses robust contract documentation	Y		
O8	To allow the University to have a clear understanding of its non-pay spend	Y		Produced sophisticated figures
O9	To ensure the process is fit for purpose and to identify potential efficiencies	Y		

O10	To give all staff an overall understanding of university procurement processes and where they can receive assistance	Y		
O11	To ensure a baseline level of knowledge of procurement matters	Y		
O12	To enable the monitoring of year on year progress of procurement activity	Y		
O13	To ensure financial regulations are fit for purpose and in line with best practice	Y		
O14	To share best practice	Y		
O15	Encourage knowledge share across the University	Y		Through sharepoint and buyers group
O16	To give access to existing and potential suppliers to useful information on procurement matters, contract, etc.	N	Lack of resources	
O17	To disseminate best practice and policy to university staff	Y		
O18	To armed University staff with appropriate skills to enable them to perform	WIP		Will be looking at training programme
O19	To ensure that the contract terms and conditions used are appropriate, in line with best practice and reference current legislation	Y		
O20	To ensure that University procurement processes follow recognised best practice and support the University's wider aims and objectives	Y		
O21	To ensure that contract management is proactive maximising the benefits of the relationship	N	Will be carried out in the next strategy	Contract management is not well developed Still use paper based In the next strategy, one of the things to be looked at is when they have big contracts, is to put in the plan how they going to manage them

O22	To ensure the university achieves efficiency gains from economies of scale and lower transaction costs	WIP		Lower transaction cost: Working towards consolidated invoicing, rolling up more procurement cards,
O23	To increase the usage of local suppliers	WIP		Tried but the usage of local suppliers is not increased
O24	To assess e-procurement solutions impact on governance and process	WIP		No funding from university at the moment
O25	To ensure that relevant risks are considered as part of the procurement process to ensure that contracts are fit for purpose	WIP		In the next strategy, there will be a big risk section in it,
O26	To enable meaningful spend data to be produced	Y		
O27	Allows the university to concentrate resources on key suppliers and reduces the transaction costs of managing numerous suppliers	WIP		
O28	Achieve efficiency gains from reducing the university's requirements for works supplies and services	N	University is going through a mass expansion programme because of the changes of the sector like funding, etc. Spend on building refurbishment to attract new students	Spend on work increase No efficiency gains
O29	To improve suppliers' access to public sector procurement opportunities within the local areas where the University of Brighton operates e.g. Brighton & Hove, Eastbourne, etc. and provide efficiency gains for the public Hastings sector bodies concerned	N	Not sure how to implement this.	

M1	sets a clear framework for procurement throughout the University for the next four years.	Y		
S1	To centralise the placing of orders via procurement cards in Procurement Services	Y		<ul style="list-style-type: none"> <li>• Relates to procurement card</li> <li>• Short term goal – that will be changed to devolving it back to department</li> <li>• Had procurement card centrally, ppl have used this idea and now running a pilot to get all of ppl to use procurement card</li> <li>• Done by individual school</li> </ul>
S2	Produce standard Pre-Qualification Questionnaires (PQQ) and Invitation to Tender (ITT) documents	Y		
S3	Identify university staff with procurement responsibility and quantify roles	Y		Going to re-do this to get nominated representative from dept and school
S4	Work with other public sector bodies within the city of Brighton & Hove and the wider university sector.	Y		
S5	Work with Finance, the Clerk to the Board and Internal Audit to develop a register that identifies external business interests of university staff	Y		
S6	To produce an easily understood guide to university procurement	Y		<ul style="list-style-type: none"> <li>• Plan to move all the related procurement documents to university sharepoint by August 2015</li> </ul>
S7	Work with the university's internal legal staff to formalise the university's contract formation procedures	Y		
S8	Develop a database, consult with departments and populate with data	Y		
S9	Undertake a review of the supplier set up process	Y		
S10	Undertake a review of the waiver process	Y		

S11	Develop a brief guide to procurement that can be given to new staff during the induction process and to other staff as required	Y		Plan to move all the related procurement documents to university sharepoint by August 2015
S12	Deliver training covering tendering procedures, sustainability, negotiation and EU procurement regulations	Y		
S13	Develop a system of monitoring procurement activity in the university against the KPIs	Y		
S14	Review the financial regulations relating to procurement	Y		Will be going through further review with new re-write in August
S15	To establish an procurement forum for all those who have responsibility for procurement within their departments	Y		A number of buyers group has been created: Technical equipment group Information services group General office products and services
S16	Develop an external website to post information regarding procurement, contracts and opportunities to work with the university	WIP		Webpage is still not well developed and suppliers do not have access to procurement documents/ contract at the moment, lack of resources to execute this idea
S17	Increase the presence of procurement related material on StaffCentral so that university staff have access to template documents, guidance and policy	Y		Plan to move all the related procurement documents to university sharepoint by August 2015
S18	Develop a comprehensive training programme utilising appropriate methods covering financial regulations, EU procurement, negotiation, sustainability, tender evaluation, contract management	WIP		Budget is not approved by UoB at the moment Offered training on financial regulations, do one-to-one course on procurement which does not get many people interested, Lack of resources to run all of the training programme as listed
S19	Develop Standard evaluation models, supplier letters, terms & conditions and process flow chart	Y		

S20	Review the standard terms and conditions used by the university for different contract areas	Y		
S21	Develop procurement policy to cover including Procuring for Sustainable Objectives, Using New Suppliers, Value for Money and the use of university wide contracts, Collaboration including Consortia and Shared Services, Customer Service and Whistle Blowing	Y		
S22	To identify the large/strategic suppliers and work in partnership with the departments to develop relationships	WIP		
S23	Tendering & Evaluation, EU procurement, sustainable procurement and negotiation	Y		
S24	Investigate university spend data to identify areas where demand can be aggregated into university wide contracts	WIP		Areas of demand are yet to be aggregated into university wide contracts
S25	Develop an engagement programme to encourage local suppliers top bid for university contracts	WIP		
S26	Investigate the e-procurement solutions on the market and including e-tendering, e-auctions, contract management, marketplaces, etc.	WIP		Application for funding is still pending The need to have e-procurement has been noted by the audit committee
S27	Develop a simple process that manages appropriate risks e.g. university objectives, whole-life cost, market approach, scope, cost, time scales, sustainability, etc.	Y		
S28	Investigate ways to introduce spend categorisation data to be produced from the eFin system and investigate different categorisation structures	Y		
S29	Reduces the number of suppliers who contract with the university	WIP		
S30	Enable the management of university demand	N	Difficult to implement	
S31	To work towards localised standardisation of public sector procurement documentation and process	WIP		Replicate council documents
T1	Centralise the use of procurement cards	Y		Looking at a plan to limit decentralisation
T2	Develop standard documentation	Y		



T3	Audit of staff with procurement responsibility	Y		Re do
T4	Develop working links with other public sector bodies	Y		Links with Brighton and Hove council, East Sussex council Links with other universities that we buy gas with
T5	Develop a register of business interests	Y		
T6	Produce a Selling to the University Guide	Y		
T7	Formalise the university's contract formation procedures	Y		
T8	Develop and populate a database for all university contracts/ agreements	Y		
T9	Review of supplier set up process	Y		
T10	Review of waiver process	Y		
T11	Develop a brief guide to university procurement	Y		
T12	Deliver procurement training	Y		
T13	Develop a procurement information monitoring system	Y		
T14	Annual review of the financial handbook and financial regulations	Y		
T15	Development of a Forum for staff involved in procurement	Y		
T16	Develop procurement pages for the university's website	Y		Moving to sharepoint
T17	Develop procurement presence on StaffCentral (staff intranet)	Y		
T18	Develop a training development plan for all procurement roles in the university	Y		Waiting for funding
T19	Develop standard documentation	Y		
T20	Review of university terms & conditions	Y		
T21	Develop procurement policy	Y		
T22	Develop relationships with large/strategic suppliers	WIP		Start of contract mgmt.
T23	Develop procurement guidance	WIP		More guidance to be produced
T24	Review spend data and set up appropriate university wide contracts	Partly implemented		Spend data Y Wide contract N
T25	Develop an engagement programme with local suppliers	N		

T26	Investigation of e- procurement solutions	WIP		Funding
T27	Implement Pre tender Risk appraisals for all large/strategic contracts	Y		Got a model and have used it on a few contracts, but have not roll out further on a larger contract Not in final version
T28	Develop a methodology for spend categorization	Y		
T29	Enable the supplier rationalization	Y		Very difficult Decentralising procurement cards might help
T30	Demand management	N	Difficult to implement	
T31	Standardisation of localised public sector procurement process and investigating Shared Service Options	WIP		Limited

## **6.5.2 Revised Goal Model**

In this section, we will divide all the objectives that are supposed to be met as listed in the UoB Sustainable Procurement Strategy 2011–2015 into two subheadings according to their current status of implementation: 1) achieved objectives and 2) objectives not achieved. These are the outcomes of the evaluation exercise that was carried out with all the key people in procurement department via interview method as described above in Section 6.5.1. The focus is on objectives as they are the things that represent concrete outcomes and activities.

### **6.5.2.1 Achieved objectives**

According to the internal consistency exercise done with people from university procurement department, it can be concluded that not less than 80% tasks of the procurement plan towards sustainable procurement strategy was implemented.

However, the way staff deals with the new systems is still an issue. Procurement staff argued staff should be forced to accept and practice the new rules, regulations or a system that is imposed by procurement department. It is found that the implementation of the new strategy is difficult due to the issue when the staff often break the rules by doing something that is against the procurement procedures such as signing off the things they are not supposed to. This is caused by the short-comings in the governance structure.

It is noted that the fact that this strategy was action based rather than requirements/process based may be factor. Requirements can be designed so that people have to follow them as in the case of the Seven-Eleven case study

(Bleistein et al., 2005). One interpretation of sustainability is the degree to which a system remains intact and valid over time. This is an example of something which is not. Given that procurement gives/withholds people the goodies to/from people, there would be plenty of ways of enforcing compliance. One can envisage a system where non-compliant staff would be excluded from the ordering process. Use of IT systems which require particular mandated inputs can help enforcement.

Knowledge sharing is not only encouraged among procurement people but also among other staff in the university as well. O15 *Encourage knowledge share across the University* has been carried out by enabling the process of knowledge sharing through university sharepoint and buyers group. The use of sharepoint is the new implementation strategy that was not available when the strategy was originally drafted.

Out of 29 objectives that were planned to be achieved by end of 2015, just over 50% were successfully met. This compares to the nearly 80% of planned tasks that were successfully completed. This suggests that in at least some cases completed tasks did not lead to the successful outcomes that had been expected.

#### **6.5.2.2 Objectives not achieved**

The feedback from the review conducted with procurement staff, showed that a number of objectives are not achieved because the tasks/tactics were still ongoing while others were waiting to be started. The reasons for this were various. Procurement officers reported that it appeared that the University had

reduced spending on various programmes due to the financial demands of building refurbishment that had been undertaken and this affected the implementation of the 5-year procurement strategy plan. This could happen because UoB has not resourced the strategy that they presumably approved originally. It would have been different if they had had to sign a big development contract upfront. However, the procurement team still intends to implement the outstanding actions when funds are available from the university management.

Figure 6.13 shows objectives from RB that are not achieved were put in different colours.



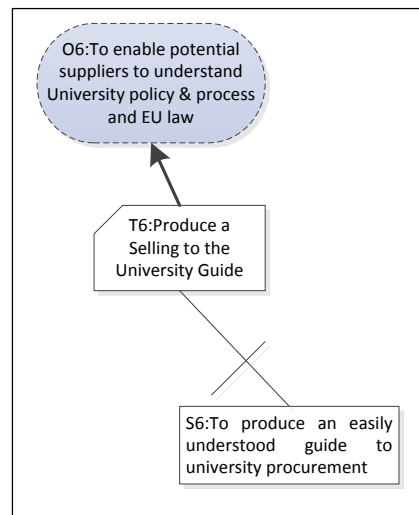
Objective (O1) *To ensure procurement practice compliance with policy* is still not achieved. Even though (T1) *Centralise the use of procurement cards* has been executed, it has now in the process of devolving procurement card purchases back to individual school. It means that any order to purchase must be made through the school they belong to instead of placing their order straight away to the centralised procurement system. Clearly this dispersion of decision making makes central imposition of environmental standards more difficult. Currently, they are running a pilot test to ensure that the practice of using procurement card could be adopted by all the staff across the university. This seems to be a reversal of the original objective. VMOST-type goal modelling needs to take account of possible changes in goals/objectives.

Objective (O3) *To give a full picture of university procurement expertise* is not achieved because of resource issue. The task to implement this objective which is (T3) *Audit of staff with procurement responsibility* has been carried out, however due to resource issue, procurement team decided to re-do this task to meet the objective

Another reason for incomplete plan is because of the slow response from information suppliers, thus objective O5 *To ensure that there is no conflict of interest within the procurement process* is not achieved. Even though the business interest register has been created to register those who are involved in procurement (refer T5 in Table 6.8), not all staff had given the feedback in order to complete their profile on the register. As of August 2015, when the interview with procurement staff took place, there had been a 75% response.

This is an example where a task depends on external parties behaving in a particular way is always high-risk.

Figure 6.14 below shows objective O6 that is not completed.

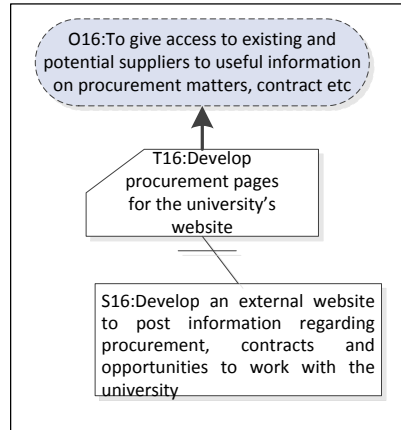


*Figure 9: Incomplete objective for O6*

O6 is still a work in progress at the time this thesis was written even though the task dedicated for this objective was completed. O6 is also a difficult objective to assess as successful as it requires measuring external bodies. This also suggests another needed task ‘distribute guides’ was not identified. This is due to the changes of strategy to move all the related procurement documents to university sharepoint by August 2015.

The reason O16 *To give access to existing and potential suppliers to useful information on procurement matters, contract, etc.* is not yet achieved is lack of resources as shown in Figure 6.15 below. The task is said to be completed however webpage is still not well developed and suppliers do not have access to procurement documents/ contract. This might also the outcome of the change of strategy to move to sharepoint.





*Figure 10: Incomplete objective for O16*

Figure 6.16 below shows another incomplete objective. The funding issue is the reason O18 *To arm University staff with appropriate skills to enable them to perform* is not achieved. To make sure that the staff members are equipped with appropriate skills, they need to undergo a related training programme. However, the UoB is yet to approve budget allocated for staff training. Another problem that cause the objective not achieved is not many staff interested when training was offered. The UoB also is lacking resources to run the entire training programme.

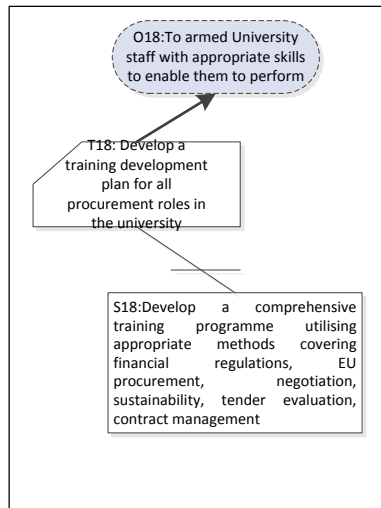


Figure 11: Incomplete objective for O18

Figure 6.17 below shows one of the objectives that was not completed.

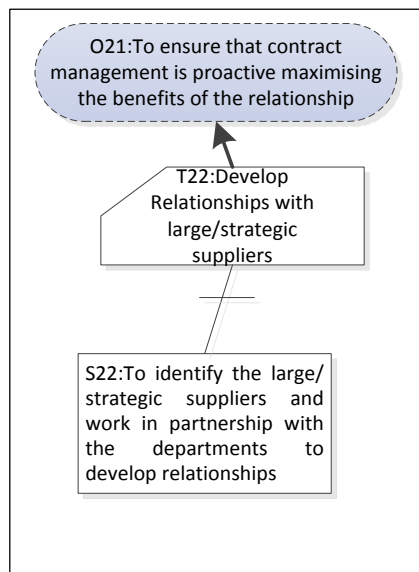
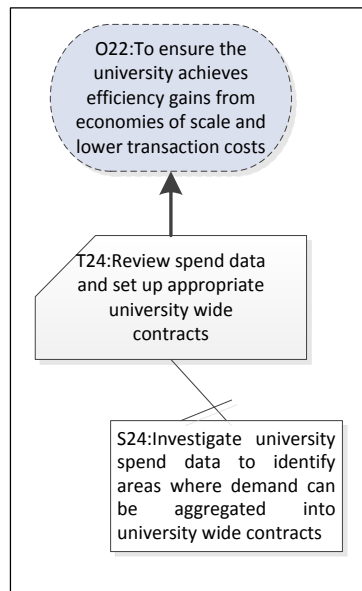


Figure 12: Incomplete objective for O21

It is found that T22 *Develop relationships with large/strategic suppliers* is not yet completed, thus objective O21 *To ensure that contract management*

*is proactive maximising the benefits of the relationship could not be achieved because contract management is not well developed.*

Tactic T24 *Review spend data and set up appropriate university wide contracts* is still in progress, thus not meeting objective O22 *To ensure the university achieves efficiency gains from economies of scale and lower transaction cost.* Figure 6.18 shows the incomplete objective.



*Figure 13: Incomplete objective for O16*

The strategy for this objective is S24 *Investigate university spend data to identify areas where demand can be aggregated into university wide contracts* is not implemented. The feedback from the interview stated that areas of demand are yet to be aggregated into university-wide contracts.

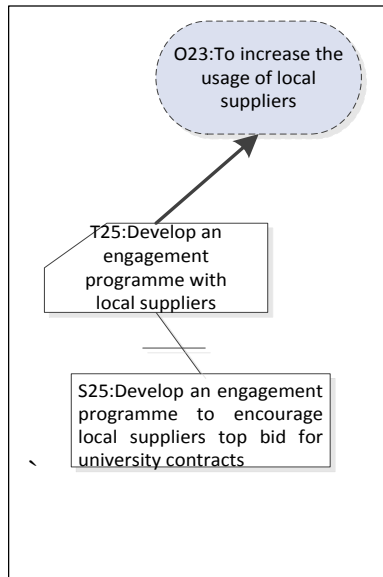


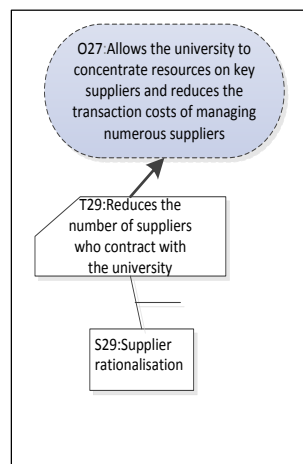
Figure 14: Incomplete objective for O23

Figure 6.19 above shows objective O23 *To increase the usage of local suppliers* is not fulfilled because the execution of T25 *Develop an engagement programme with local suppliers* has not improved the rate of local suppliers. This is another example where task depends on external parties behaving in a particular way which is always high-risk; that is, there had been a lack of interest by local suppliers.

The tactic to achieve O24 *To assess e-procurement solutions impact on governance and process* is T26 *Investigation of e-procurement solutions* is still in progress. The need for this software has been acknowledge by the university audit committee but the funding approval is still pending. This is one of several cases where central university has not resourced the strategy that they presumably approved originally. It would have been different if they had had to sign a big development contract upfront. However, it is noted that

the strategy document as written does not cover the actual implementation of an 'e-procurement solution'.

T27 *Implement Pre tender Risk appraisals for all large/strategic contracts* was carried out to achieve objective O25 *To ensure that relevant risks are considered as part of the procurement process to ensure that contracts are fit for purpose*. However, the objective is not met because even though the tactics were done but it is not in final version. The feedback from procurement staff stated that the implementation do not consider large contract.



*Figure 15: Incomplete objective for O27*

For tactic T29 *Enable the supplier rationalisation*, even though it was being executed, but it was found that it was difficult to do this. Figure 6.20 shows this situation. The written strategy was S29 *Reduces the number of suppliers who contract with the university* might not suitable to be implemented. Thus, O27 *Allows the university to concentrate resources on key suppliers and reduces the transaction costs of managing numerous*

*suppliers* is not complete. The feedback from procurement staff suggested that decentralising procurement cards might help to achieve this objective. This is an example of change of strategy.

Another changes in procurement plan happened when the university decided to refurbish one of its main building. The university is going through a mass expansion programme because of the changes of the sector like funding. Building refurbishment has somehow impeded the implementation of O28 *Achieve efficiency gains from reducing the university's requirements for works supplies and services* as shown in Figure 6.13. The feedback obtained from the key people in procurement department is that the strategy (S30 *Manage university demand*) to achieve this objective is quite challenging to be implemented because it involved all the buyers across the university; procurement staff need to ask budget holder in the university about the stuff they ordered; whether those specifications of the stuff chosen by the buyer are really needed. This is not surprising given that devolved budget responsibility to school and department heads remains in place. Procurement officers are not in a position to tell local managers what their needs really are. The problem occurs when every buyer requires different specifications according to their needs. A key criterion for spending money is assessing Value for Money. This means looking at benefits as well as costs. The procurement department can identify costs but is not able to assess benefits. This has to be done by schools and departments. The feedback obtained was the 2016–2019 procurement strategy puts more emphasis on the role of schools that now have to develop department procurement plans.

### 6.5.3 Revised Information Model

After goal model was constructed and interviews were conducted to gain feedback from procurement staff, we have noticed that there is more information needed in making sustainable decisions of any purchased products. Thus, it is crucial to add this information to the information model. There are eight new information were identified. They are:

- Upcoming contract register for the new contracts,
- business interest register,
- procurement guide (instructions of procurement process),
- best practice (integrates with procurement guide),
- procurement policy (based on best practice and procurement guide),
- whole life cycle (consider purchase cost and maintenance cost over its lifetime),
- risk register and
- risk assessment

Figure 6.21 shows the revised information model. These eight information sources came from different places, either relate to internal information (e.g. contracts register, business interests register) or would have to modify external information to make it relevant to UoB (e.g. risk assessment).

The upcoming contract register is created as suggested in the Procurement Strategic document to store all the agreements and contracts that the university has to make sure that they are very clear of their non-pay spend.

Business Interest register identifies the links of university staff with external university suppliers make sure that there is no conflict of interest within procurement process. This register will link to Suppliers' list.

As stated in Procurement Strategic document, the first version of a brief guide to university procurement should be developed between January 2011 and July 2011 prior to developing procurement policy which is scheduled between August 2011 and July 2012. An easily understood procurement guide is needed to ensure the potential suppliers understood EU procurement laws and also UoB policy and process.

The sequel of Procurement Guide is developed after Procurement Policy is in the place, between August 2011 and July 2012. This guide will provide information on tendering and evaluation of contracts according to EU laws and also guide on sustainable procurement. The selection of suppliers also should be included in Procurement Guide. In information model, Procurement Guide is linked to Suppliers Appraisal. After a brief guide to university procurement is developed, Procurement Policy is produced. Thus, there is a link between these two documents. Another piece of information to be included in information model is Best Practices. Best practice would be incorporated in the Procurement Guide. As Best Practice should be disseminate among university staff, making decision on sustainable procurement should be in line with Best Practice as well.

Risk Register will lists types of risk encounters such as suppliers/ product risk. Risk Assessment to be added to the information model is used to prioritise the risks encountered during the decision-making process.

Finally, the whole life cycle is another piece of information that needs to be considered in making decisions. Details such as purchase cost, maintenance cost and



product lifetime are the types of information to be accessed through whole life cycle information. This information can be integrated into contract criteria; for example, suppliers have to offer free maintenance service for the first three years. WLC will also need information from the potential users, such as the mode and volume of use of the equipment.

Considering that new information that was added to the information model, the way the information model is navigated should be different. Below example is similar to the scenario presented in Section 4.9.

***Explanation of scenario in procurement information model***

As the scenario describes, IS officer would like to identify the list of laptops that meet sustainable criteria. In the information model the following steps were performed:

1. ***IT Product*** is selected, in this case, the laptop.
2. Given the IT product, she needs to find the National Desktop and Notebook Agreement (NDNA) for laptops (***Framework Agreement***).
3. ***Approved suppliers list*** will be displayed.
4. From the approved suppliers list, she is able to see the name of the suppliers and the list of laptops brand (***Product Manufacturer***) that is available, for example, Toshiba, Lenovo, etc.
5. She can choose to view any suppliers that are not university staff and their product in details (***Product Model, Product Certification, Product Specification, Contracts Criteria***) and come out with the list of laptops that meet sustainable criteria for future reference.

6. Check *business interests register* to avoid conflict of interest when procurement sign the purchase off.

The navigation process is changing because new information is considered. It is noted that procurement process is done based on procurement guide (included in Information Model). So, it seems that the procedures guide the way the model would be navigated. If the procedures changed, it might change the navigation of the model.

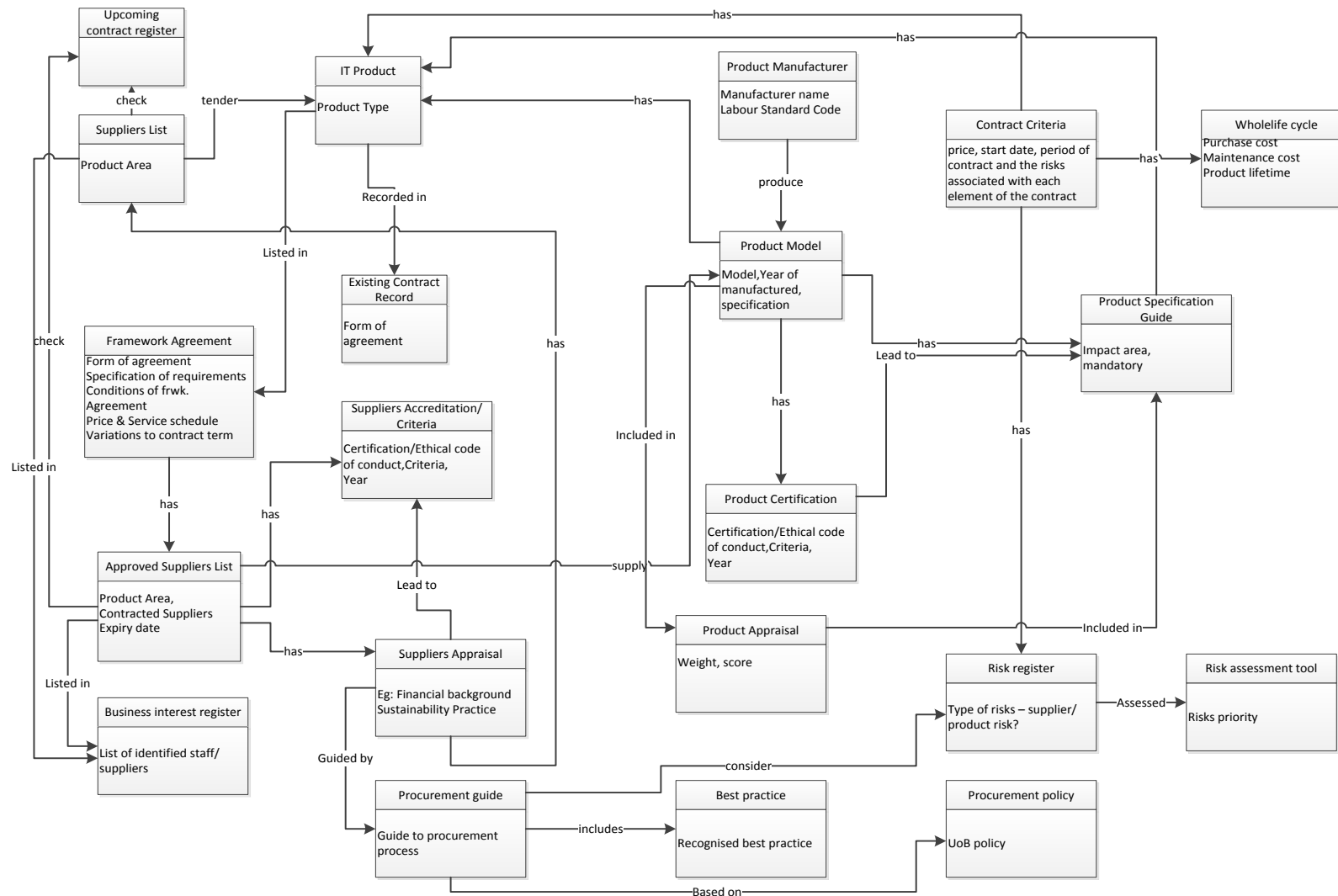


Figure 16: Revised information model

#### 6.5.4 UoB Content Validity: Method and Results

This validity test is performed to ensure that the terminology used in the procurement strategy documents are interpreted correctly when they are used to construct goal model. This is important when it comes to identifying the links between goal, objective, strategy or task. Misinterpretation of terms could lead to inaccuracies in goal and information models.

However, not much terminology needed to be clarified. During the interviews, the interviewees were asked to explain the terms or words with which the researcher was unfamiliar such as waivers, whole-life cost and procurement cards.

Content validity is concerned with ensuring that goals, objectives, strategies and tasks are modelled correctly, particularly dependencies such as the right task is implementing the right objective. For example, T27 *Develop a methodology for spend categorisation* is carried out to implement O22 *Investigate university spend data to identify areas where demand can be aggregated into university-wide contracts*.

However, validity is less of a risk because (a) the data comes from the procurements staff's own documentation and (b) a thorough discussion of the results of the modelling with procurement staff was conducted. As the planned strategy was actually implemented, rather than being a retrospective reconstruction, it is thus more valid than some other more theoretical investigations.

As a conclusion, the uses of B-SCP goal modelling are to:

- 1) validate the information model (some new information may be added to the model based on the analysis on goal model) and

- 2) verify whether the changes that are planned by UoB for sustainable procurement as written in procurement strategic plan were really implemented by the end of 2015.
- 3) assess whether the selected strategies led to the achievement of the desired objectives.

## **6.6 Relationship between Actor Network Diagram and B-SCP Goal Context**

This section explains the link between actor network diagram produced in Figure 2.3 and B-SCP goal context in Appendix E. This is important to see the integration of actor network diagram with B-SCP to identify its context domain. The use of actor network diagram to match with context domains in B-SCP is a technique that we propose in this research.

Considering that actor network diagram in Section 4.8 was based on interviews which explored the process for purchasing IT products in the CEM school. This reflected the general procurement process for the whole university, so the two diagrams should match approximately. The overlapped area of the two diagrams enables the identification of the main participants in the procurement process at UoB. Thus, the actor network diagram could be created prior creating B-SCP goal model and then be used to support and validate the goal context of the subsequent B-SCP model. For the purposes of this research, the nodes did not represent individual actors, but the roles that actors might enact. It might be expected that many nodes in the actor network diagram would exist as domains in the B-SCP goal context. The relationships between different roles in the actor network diagram would be expected to be shared phenomena in the B-SCP context model between the domains.

Actor network diagram that we produced was based on the current procurement process at the time the interviews were carried out in 2013. The changes to the procurement process that should be implemented by end of year 2015 are not reflected in this diagram. However, context diagrams derived from the strategy document will be up to date.

Some differences between the actors in actor network diagram and goal context diagrams are because of differing viewpoints. The original operational system and the diagram for the new implementation project are models of different but interrelated things; for example, the latter has actors like the implementation team. Those within the School of CEM who carried out some specific tasks, particularly to do with purchase decisions for procurement at the school level are not included in the B-SCP context diagrams as this lower level was not subject to scrutiny in the Sustainable Procurement Strategy while the actor network diagram tended to miss those involved in the procurement process at the university level. The actor network diagram is valuable as it shows that some parts of the university procurement policy at school/department level have been ignored by the procurement strategy document. Another difference is that the first was model of an operational process while the other was a model of a business change programme.

As shown in Table 6.8 below, five actors were identified as the key stakeholders appearing in the actor network diagram and the goal context in the university procurement process. The five actors were: procurement staff, buying staff, eFin, finance staff and suppliers. The rest of the actors in the actor network diagram, identified as HoD/Budget Holder, School Resources Group Chair, School Resources Group committee, School Representative and Information Services, were those involved in procuring IT products at the school (CEM) level. They were not mentioned in the goal context because the strategy document used to create the goal model only discussed the procurement strategy

for the whole university. Some actors from the goal model that were not mentioned in actor network diagram because their roles are actually created by activities implemented by the procurement strategy, for example, the UoB change implementation team, regulation bodies such as SUPC (this is not mentioned in actor network diagram because the level of discussion is not to that level of details), external bodies such as Brighton and Hove Council, public sector procurement, StaffCentral, UoB procurement website, external organisations, local public bodies, UoB internal legal staff and UoB strategic partners. The StaffCentral and UoB procurement websites will be used to share information such as guidelines and policy document among university staff with regard to procurement process. At the time the actor network diagram was created, the StaffCentral and UoB procurement websites already existed but were not fully utilised for procurement purpose. However, these two platforms will be utilised for the procurement purpose according to the strategic procurement document, thus they were mentioned in the goal context.

In conclusion, the actor network diagram could be created prior to the development of B-SCP goal model to verify the main actors. The use of the actor network diagram also could help in identifying the new actors after the change plan has been implemented.

### **6.7 Relationship between B-SCP Goal Model and Information Model**

As mentioned in Section 6.5.4, B-SCP goal model could help in validating information model, by identifying new information that is used in making sustainable procurement decisions and this new information needs to be added to the information model. However, a little gap exists between the details of the goal model which is the procurement strategic plan and the details/elements in the information model. The lack of overlap between the low-level processes at school/department level and the high-level procurement office strategy suggests that, similarly, little in common will be found between the B-SCP goal

model and the information model. The actual decisions about environmentally friendly products are actually done at the lower level and the strategy document essentially ignores environmentally sustainable product selection. In this section, the connection between these two models will be explained.

For each element in B-SCP Goal model which has been categorised using the VMOST framework and presented in a table, an additional piece of information has been identified for each category which is its final product. Table 6.8 described each VMOST elements complete with *Interaction ID*, *Shared Phenomena* and *Final Product(s)*. Interaction ID is the code used to label all the interactions occurs between entities in the goal model. For example, as extracted from Procurement Strategic document, '*G2 Require appropriate procedures to eliminate the inconsistency of delivery of sustainable procurement objectives and the management of risks but be flexible enough to allow creativity and innovation*', there are two responsible context identified which are UoB Change Implementation Team and UoB Procurement Staff. The interaction or shared phenomena between these two entities is labelled as '*fa*'. Shared phenomenon is activity shared by two domains (Bleistein et al., 2005).

The Final Product(s) column is seen as the connector between B-SCP goal model and information model. Each elements in VMOST framework yields outcomes or final products, for example, as extracted from the Procurement Strategic document, '*O11 Develop a brief guide to procurement that can be given to new staff during the induction process and to other staff as required*' will yield *P2 Procurement guide*. Final products of B-SCP goal model are the elements that build the information model. However, information model does not include all of the B-SCP final products for the following reasons:



1. The strategic plan discussed the change plan from the high-level view of procurement process, from developing framework, documentation and process to specific task.
2. The information model only considered the types of information needed to make informed decisions about the purchase of products with particular regard for their environment impact while some information in the goal model related to the role of managing procurement staff, for example *P10 List of available training programme*, and not the responsibilities of the actual procurement staff.

The elements in the information model that did not match the goal model include framework agreements, product manufacturer, product model, product certification and product appraisal documents related to the specific products. It could be argued that *'review spend data and set up appropriate university wide contracts'* would require analysis at product level, *'Develop a methodology for spend categorisation'*, *'supplier rationalisation'* and *'demand management'* could also involve product analysis. However, while the goal model did not address these products in detail, *'P26 Product Specification Guide'* mentioned in both goal model final product and information model, did mention these elements.

To be more precise about the relationship between the Goal model and the Information model, it can be seen that the relevant outcomes of each element in VMOST are the elements that create the information model. Each of the task/tactic to be implemented by UoB as stated in the strategic plan that bring about the outcomes described by the objectives. Final products may come from different sources, it can be internal or external of the organisations. Some change actions might produce their own products, for example, *'G3 To have lean processes that minimise transaction costs and*

*will cover tendering & evaluation, contract formation, waivers, the set-up of suppliers and contract monitoring'* leads to the production of '*P2 Procurement Guide*', while some actions led to the information located externally. For example, to produce *P26 Product Specification Guide*, we need to get some information which is located outside the organisation. The other elements that lead to *P26 Product Specification Guide* are *Product Certification, Product Appraisal, Product Model* and *Product Manufacturer*. Product Certification, Product Model and Product Manufacturer obviously come from external organisations such as ENERGY STAR® and product manufacturing companies. This is why information model is relevance because it linked all the information either from internal or external sources to be used in making informed sustainable decisions.

To conclude, with regard to the mapping between the goal model and information model, implemented tactics/objectives often lead to final product(s) in the form of information or documents. The final product(s) relevant to sustainable procurement for the university could be used to build an information model.

## **6.8 Chapter Summary**

As noted earlier, the goal model is created based on UoB procurement strategy document. We adopted B-SCP technique; however there is some slight changes done to the original approach. Firstly, the order of notational elements is different to B-SCP. Since we created the goal model to represent UoB procurement strategy document, it is important that we come out with a model that satisfies the structure of the document. The goal model is translated from the table in UoB procurement strategy document, so it is easier for UoB procurement staff to evaluate this goal model which is based on the document that they are familiar with. The explanation can be found in Section 6.4.1.

Secondly, the concept of central machine is not applied in this research due to difficulty to identify central machine that would provide the information needed as explained in Section 6.4.2.

Thirdly, the domains in goal model were selected according to its nature. For example, tasks related to produce documentation is grouped together.

While VMOST can be used to help our understanding of the strategy document, there is some issue arise when not all elements in VMOST framework are implemented due to many reasons.

In conclusion, based on what has been demonstrated, the goal model will change when the strategy/objectives change. Therefore, VMOST-type goal modelling should take this into account.

Table 12: Decomposition of strategy plan into VMOST

<b>ID</b>	<b>Description</b>	<b>Theme (1-Governance 2-Policy 3- Process 4-Delivery)</b>	<b>Links to</b>	<b>Responsible domain Context 1</b>	<b>Recipient domain Context 2</b>	<b>Inter action id</b>	<b>Shared Phenomena</b>	<b>Final product</b>
V1	The university meets its requirements for works, supplies, services, and utilities in a way that achieves value for money on a whole-life basis in terms of generating benefits to society and the economy, whilst minimising damage to the environment and providing for long-term financial stability.			UoB	n/a	n/a	n/a	
G1	Appropriate governance		V1	UoB Procurement staff	UoB	aa	procurement process flow, relationships management protocol	
				UoB Procurement staff	Suppliers	ba	suppliers selection procedure	
				UoB change implementati on team	UoB	ca	Sustainable procurement actions coordination	
				UoB Procurement staff	Regulation bodies	da	Sustainability compliance guide	

				UoB Procurement staff	UoB staff	ea	procurement process flow, UoB procurement procedures, feedbacks, communication compliance protocol, procurement guide	
G2	Policies for procurement		V1	UoB change implementation team	UoB Procurement	fa	procurement process flow, UoB procurement procedures, UK procurement legislation	
G3	Defined process		V1	UoB change implementation team	UoB Procurement	fa	UoB procurement procedures, Procurement policy	
G4	Delivery capability		V1	UoB change implementation team	UoB Procurement	fa	UoB procurement procedures, Procurement policy	
O1	To ensure procurement practice compliance with policy	1,2,3,4	1,2,3,4	UoB Procurement staff	UoB buying staff	ab	Procurement policy, procurement process flow	
O2	To give staff readymade tools to assist with their procurement role	3,4	3,4	UoB change implementation team	UoB Procurement staff	cb	Tender evaluation, contract, standard documentation, procurement	

							policy, procurement guide,	
O3	To give a full picture of university procurement expertise.	4	4	UoB Procurement staff	UoB staff	ab	Procurement guide, Job description	
O4	Investigate ways of sharing expertise and increasing collaboration	4	4	UoB Procurement staff	Public sector bodies	ad	Information posting, knowledge sharing protocol	
O5	To ensure that there is no conflict of interest within the procurement process.	1	1	UoB procurement staff	UoB staff	bb	staff profile	
O6	To enable potential suppliers to understand University policy & process and EU law	2,4	2,4	UoB change implementation team	Suppliers	bd	University procurement policy, procurement process flow	
O7	To ensure that the university possesses robust contract documentation	1,2,3,4	1,2,3,4	UoB change implementation team	UoB procurement staff	ec	Standard contract document, procurement process flow	
O8	To allow the University to have a clear understanding of its non-pay spend	4	4	UoB change implementation team	UoB	ac	Spend data	
O9	To ensure the process is fit for purpose and to identify potential efficiencies	1	1	UoB Procurement staff	Suppliers	bb	Supplier performance score, supplier management information, feedback	
O10	To give all staff an overall understanding of university procurement processes and	1,2,3,4	1,2,3,4	UoB Procurement staff	UoB staff	be	Procurement processes flow Procurement guide	

	where they can receive assistance							
O11	To ensure a baseline level of knowledge of procurement matters	2,3,4	2,3,4	UoB change implementation team	UoB Procurement staff	ae	List of training	
O12	To enable the monitoring of year on year progress of procurement activity	1,2,3,4	1,2,3,4	UoB Procurement staff	eFin system	bc	Procurement activity, performance, spend data	
O13	To ensure financial regulations are fit for purpose and in line with best practice	1,3,4	1,3,4	UoB Procurement staff	UoB Finance staff	bb	Financial regulations, procurement procedures	
O14	To share best practice	2,3,4	2,3,4	UoB Procurement staff	UoB staff	be	Knowledge sharing protocol	
O15	Encourage knowledge share across the University	2,3,4	2,3,4	UoB Procurement staff	UoB staff	be	Knowledge sharing protocol	
O16	To give access to existing and potential suppliers to useful information on procurement matters, contract, etc.	1,2,4	1,2,4	UoB Procurement staff	Suppliers	cd	Procurement information	
				UoB Procurement staff	University procurement website	dd	Information posting	
O17	To disseminate best practice and policy to university staff	1,2,4	1,2,4	UoB procurement staff	StaffCentral	ce	Information posting	
				StaffCentral	UoB staff	de	Best practice, university procurement policy	
O18	To armed University staff with appropriate skills to enable them to perform	1,2,3,4	1,2,3,4	UoB change implementation team	UoB staff	ee	List of trainings, KPI list	

O19	To ensure that the contract terms and conditions used are appropriate, in line with best practice and reference current legislation	1,2,4	1,2,4	UoB change implementation team	UoB procurement staff	ec	Current legislation, best practice, contract	
O20	To ensure that University procurement processes follow recognised best practice and support the University's wider aims and objectives	1,2	1,2	UoB change implementation team	UoB procurement staff	ec	Procurement processes flow Procurement guide, best practice	
O21	To ensure that contract management is proactive maximising the benefits of the relationship	4	4	UoB Procurement staff	Suppliers	cc	Supplier performance score, supplier management information, feedback	
O22	To ensure the university achieves efficiency gains from economies of scale and lower transaction costs	2,4	2,4	UoB procurement staff	Suppliers	fe	Suppliers selection procedure, supplier profile	
O23	To increase the usage of local suppliers	2,4	2,4	UoB Procurement staff	University procurement website	dd	Contract opportunities information sharing	
O24	To assess e-procurement solutions impact on governance and process	1,3	1,3	UoB change implementation team	UoB Procurement staff	cb	Assessment report	
O25	To ensure that relevant risks are considered as part of the procurement process to ensure that contracts are fit for purpose	4	4	UoB procurement staff	UoB buying staff	ab	Procurement processes flow, Procurement guide	
O26	To enable meaningful spend data to be produced	2,4	2,4	eFin system	UoB procurement staff	dc	Spend data report	



O27	Allows the university to concentrate resources on key suppliers and reduces the transaction costs of managing numerous suppliers	2,4	2,4	UoB procurement staff	suppliers	cd	Suppliers selection procedure, supplier profile	
O28	Achieve efficiency gains from reducing the university's requirements for works supplies and services	4	4	UoB change implementation team	Suppliers	db	Procurement processes flow Procurement guide	
O29	To improve suppliers' access to public sector procurement opportunities within the local areas where the University of Brighton operates e.g. Brighton & Hove, Eastbourne, etc. and provide efficiency gains for the public Hastings sector bodies concerned	2,3,4	2,3,4	UoB change implementation team	suppliers	bd	Contract opportunities Information sharing	
					Public sector procurement	ed	supplier profile (local suppliers/sustainable suppliers)	
M1	sets a clear framework for procurement throughout the University for the next four years.	n/a	V1	UoB	UoB change implementation team	ca	University vision, aims and objectives	
S1	To centralise the placing of orders via procurement cards in Procurement Services	1,2,3,4	O1	UoB change implementation team	UoB Procurement staff			
S2	Produce standard Pre Qualification Questionnaires (PQQ) and Invitation to Tender (ITT) documents	3,4	O2	UoB change implementation team	UoB Procurement staff			
S3	Identify university staff with procurement responsibility and quantify roles	4	O3	UoB change implementation team	UoB staff			

S4	Work with other public sector bodies within the city of Brighton & Hove and the wider university sector.	4	O4	UoB Procurement staff	Public sector organisations			
S5	Work with Finance, the Clerk to the Board and Internal Audit to develop a register that identifies external business interests of university staff	1	O5	UoB change implementation team	UoB procurement staff			
S6	To produce an easily understood guide to university procurement	2,4	O6	UoB change implementation team	UoB procurement staff			
S7	Work with the university's internal legal staff to formalise the university's contract formation procedures	1,2,3,4	O7	UoB change implementation team	UoB internal legal staff			
S8	Develop a database, consult with departments and populate with data	4	O8	UoB change implementation team,	UoB procurement staff			
S9	Undertake a review of the supplier set up process	1	O9	UoB change implementation team	Supplier			
S10	Undertake a review of the waiver process	1	O9	UoB change implementation team	UoB buying staff			
S11	Develop a brief guide to procurement that can be given to new staff during the induction process and to other staff as required	1,2,3,4	O10	UoB change implementation team	UoB staff			
S12	Deliver training covering tendering procedures, sustainability, negotiation and EU procurement regulations		O11					

S13	Develop a system of monitoring procurement activity in the university against the KPIs	1,2,3,4	O12	UoB change implementation team	UoB procurement staff			
S14	Review the financial regulations relating to procurement	1,3,4	O13	UoB Procurement staff	UoB Finance staff			
S15	To establish an procurement forum for all those who have responsibility for procurement within their departments	2,3,4	O14, O15	UoB change implementation team	UoB staff			
S16	Develop an external website to post information regarding procurement, contracts and opportunities to work with the university	1,2,4	O16	UoB change implementation team	University procurement website			
S17	Increase the presence of procurement related material on StaffCentral so that university staff have access to template documents, guidance and policy	1,2,4	O17	UoB Procurement staff	StaffCentral			
				StaffCentral	UoB staff			
S18	Develop a comprehensive training programme utilising appropriate methods covering financial regulations, EU procurement, negotiation, sustainability, tender evaluation, contract management	1,2,3,4	O18	UoB change implementation team	UoB Procurement staff			
S19	Develop Standard evaluation models, supplier letters, terms & conditions and process flow chart	3,4	O2	UoB change implementation team	UoB Procurement staff			

S20	Review the standard terms and conditions used by the university for different contract areas	1,2,4	O19	UoB change implementation team	UoB Procurement staff			
S21	Develop procurement policy to cover including Procuring for Sustainable Objectives, Using New Suppliers, Value for Money and the use of university-wide contracts, Collaboration including Consortia and Shared Services, Customer Service and Whistle Blowing		O20					
S22	To identify the large/strategic suppliers and work in partnership with the departments to develop relationships	4	O21	UoB Procurement staff	Suppliers			
S23	Tendering & Evaluation, EU procurement, sustainable procurement and negotiation	3,4	O20					
S24	Investigate university spend data to identify areas where demand can be aggregated into university wide contracts	2,4	O22	UoB implementation team	UoB Procurement staff			
S25	Develop an engagement programme to encourage local suppliers top bid for university contracts	2,4	O23	UoB change implementation team	Local suppliers			
S26	Investigate the e-procurement solutions on the market and including e-tendering, e-auctions, contract management, marketplaces, etc.	1,3	O24	UoB implementation team	UoB Procurement staff			

S27	Develop a simple process that manages appropriate risks e.g. university objectives, whole-life cost, market approach, scope, cost, time scales, sustainability, etc.	4	S25	eFin system	UoB change implementation team			
S28	Investigate ways to introduce spend categorisation data to be produced from the eFin system and investigate different categorisation structures	2,4	O26	eFin system	UoB change implementation team			
S29	Reduces the number of suppliers who contract with the university	2,4	O27	UoB procurement staff	Suppliers			
S30	Enable the management of university demand	4	O28	UoB procurement staff	UoB buying staff			
S31	To work towards localised standardisation of public sector procurement documentation and process	2,3,4	O29	UoB change implementation team	Local public bodies			
T1	Centralise the use of procurement cards	1,2,3,4	O1	UoB change implementation team	UoB procurement staff		procurement process flow, UoB procurement procedures, procurement policy	P1:procurement process flow P2:Procurement guide
T2	Develop standard documentation	3,4	O2	UoB change implementation team	UoB procurement staff		procurement process flow, UoB procurement procedures, procurement policy	P3:Standard procurement documentation

T3	Audit of staff with procurement responsibility	4	O3	UoB change implementation team	UoB staff		List of job description	P4:job description
T4	Develop working links with other public sector bodies	4	O4	UoB procurement staff	Public organisations		Procurement policy, aims and objectives of collaboration	P5:Procurement collaboration description
T5	Develop a register of business interests	1	O5	UoB procurement team	UoB staff		staff profile	P6:Business interests register
T6	Produce a Selling to the University Guide	2,4	O6	UoB change implementation team	UoB procurement staff		P4: Procurement guide	P2: Procurement guide
T7	Formalise the university's contract formation procedures	1,2,3,4	O7	UoB change implementation team	UoB procurement staff		procurement process flow, UoB procurement procedures, procurement policy	P7:contract template
T8	Develop and populate a database for all university contracts/ agreements	4	O8	UoB change implementation team	UoB procurement staff		University contracts/agreements, suppliers list, product list	P8:Database
T9	Review of supplier set up process	1	O9	UoB change implementation team	Supplier		Suppliers list, suppliers appraisal, sustainability compliance guide	P9:suppliers list P1:procurement process flow
T10	Review of waiver process	1	O9	UoB change implementation team	UoB buying staff		Purchase order, buyer justification,	P1:procurement process flow P2: Procurement guide
T11	Develop a brief guide to university procurement	1,2,3,4	O10	UoB change implementation team	UoB procurement staff		procurement process flow, UoB	P2: Procurement guide

							procurement procedures, procurement policy	
T12	Deliver procurement training	2,3,4	O11	UoB procurement staff	External expertise/bodies		Training programme	P10: List of training programme
T13	Develop a procurement information monitoring system	1,2,3,4	O12	UoB change implementation team	UoB procurement staff		KPI, list of procurement activity	P11: procurement activity monitoring system
T14	Annual review of the financial handbook and financial regulations	1,3,4	O13	UoB finance staff				P12: financial handbook P13: Financial regulations
T15	Development of a Forum for staff involved in procurement	2,3,4	O14, O15	UoB change implementation team	UoB procurement staff		Best practice, procurement knowledge, related information	P14: Procurement forum
T16	Develop procurement pages for the university's website	1,2,4	O16	UoB change implementation team	University procurement website		Procurement information, related documents	P15: Procurement pages on website
T17	Develop procurement presence on StaffCentral (staff intranet)	1,2,4	O17	UoB procurement staff	StaffCentral		procurement process flow, UoB procurement procedures, procurement policy, Suppliers list,	P16: Uploaded Procurement related material on StaffCentral
T18	Develop a training development plan for all procurement roles in the university	1,2,3,4	O18	UoB change implementation team	UoB procurement staff		List of job description, list of training programmes, training objectives	P10: List of training programmes
T19	Develop standard documentation		O2					P26: Product specification guide

								P18: procurement policy P2: Procurement guide
T20	Review of university terms & conditions	1,2,4	O19	UoB change implementation team	UoB procurement staff		University terms and conditions for contracts	P17:terms & conditions
T21	Develop procurement policy	1,2	O20	UoB change implementation team	UoB procurement staff		EU procurement law, procurement process flow, sustainability compliance guide	P18: procurement policy
T22	Develop relationships with large/strategic suppliers	4	O21	UoB Procurement staff	Suppliers		Suppliers' contract opportunities, suppliers selection procedure	P9:suppliers list
T23	Develop procurement guidance	3,4	O20	UoB change implementation team	UoB staff		procurement process flow, sustainability compliance guide	P2: Procurement guide
T24	Review spend data and set up appropriate university wide contracts	2,4	O22	UoB change implementation team	UoB procurement staff		Spend data,	P19:Revised university wide contracts
T25	Develop an engagement programme with local suppliers	2,4	O23	UoB procurement staff	Suppliers		Potential engagement programme list,	P20: list of engagement programme
T26	Investigation of e-procurement solutions	1,3	O24	UoB change implementation team	UoB procurement staff		List of e-procurement solutions, e-procurement criteria	P21:e-procurement solutions comparison



T27	Implement Pre tender Risk appraisals for all large/strategic contracts	4	O25	UoB change implementation team	UoB procurement staff		Contracts, Pre tender Risk appraisals process flow,	P22: risks management procedures
T28	Develop a methodology for spend categorisation	2,4	O26	UoB change implementation team	eFin system		Spend data,	P23:spend categorisation data function
T29	Enable the supplier rationalisation	2,4	O27	UoB Procurement staff	Suppliers		Suppliers assessment report,	P9:Suppliers list
T30	Demand management	4	O28	UoB procurement staff	UoB buying staff		Purchase order, order priority,	P24:Priority management process
T31	Standardisation of localised public sector procurement process and investigating Shared Service Options	2,3,4	O29	UoB change implementation team	Local public bodies		Procurement guide, procurement process flow,	P25:Standard localised procurement document and process

## **CONCLUSIONS AND FUTURE RESEARCH**

### **7.0 Overview of Chapter**

This chapter will re-visit research questions and discuss how each of the questions is answered. There will also be discussion about research limitations, contributions and possible future work.

### **7.1 Overview of Research Context**

Decision making can be a very crucial stage in sustainable procurement. The key thing is that selecting suppliers and products on sustainable criteria means that purchasers need to be able to access large amounts of additional information. Thus, related information that could help in making the best decision should be accessible at any time. There are many types of information needed and in certain cases, one type of information could lead to another type of information ie: the list of approved suppliers is derived from framework agreements. The construction of a generic procurement information model is to cater all universities in the UK, since they are adopting the standard procurement process practice. Best procurement practice suggested by the Chartered Institute of Purchasing and Supply (CIPS) seems to reflect some of the current practice in UK universities. The information model is designed to support best practices that should address gaps derived from the current practice. The goal model is then developed based on UoB procurement strategy document to evaluate its implementation of change programme.

## 7.2 Research Questions Re-Visited

**RQ1:** What would be the appropriate type of information and processes needed to support the sustainable procurement of goods and services by public sector organisations? (Refer Section 1.3)

**RQ1.1:** What does ‘sustainable procurement’ mean in the context of UK universities?

**RQ1.2:** What are the typical current practices in sustainable procurement?

**RQ1.3:** What is recognised best practice in sustainable procurement?

To answer RQ1, all interviews conducted with all UK universities were analysed. Information that is needed to support sustainable procurement decisions comes from different sources, and most of them sit in different organisations. Interview transcripts were analysed using content analysis method, where the relevant data will be highlighted using marker pen. All of this information was then used to construct an information model to support sustainable procurement in UK universities. A revised version of information model was then developed after some new information was identified from the goal model. The information model represents the appropriate type of information needed to support sustainable procurement. The information that is necessary to be included in the information model comes from many sources such as suppliers, manufacturers, accreditation bodies, best practice, purchasing consortia, etc. Most of this information comes from external sources; however, there are also some information needed from UoB such as procurement policy, contract criteria and business register.

Our key contributions for RQ1 are:

1. There is more than one way of interpreting 'sustainable system', for example, 'green-friendly' vs remaining effective in the long term.
2. University conception of 'sustainability' centres on compliance with external authorities.
3. Sustainable procurement is essentially a matter of knowledge management.
4. Quantitative SNA works best where there is a dense homogeneous network (i.e. nodes are uniform in nature). The 'UoB' 'buyers' community seemed fragmented and varied.
5. Despite the limitations above, actor networks were useful in modelling relationships (and in this situation had some advantages over business process models).
6. The assumption that there is coherent community of practice among staff responsible for buying goods and services is largely unfounded.
7. Buyers tended to avoid taking account of 'green' criteria, mainly due to lack of information, and passed this responsibility to others (i.e. they treated green assessment as a 'black box')
8. Purchase decisions are devolved in universities (partly owing to devolved budgets).
9. Central procurement staff members feel the need for more uniformity and control; hence, this conflicts with (6) above.

10. Effective *sustainable* procurement is seen as only being possible where an effectively controlled procurement process is in place. Therefore focus on the latter by central procurement.

**RQ2:** What are the ways to assess the alignment between the change programme and organisational goals?

To answer RQ2, it is important to analyse the procurement strategic document. The Vision, Mission, Objectives, Goals, Strategies and Task were extracted from the document. Goal model can be used to assess the implementation of strategic plans because it was realised that the procurement system in UoB was not static, but would be subject to change due to the UoB Sustainable Procurement Strategic Plan. The goal model was constructed based on the procurement strategic document to find out the whole procurement process involved to fulfil the top level requirements, that is, Vision. From the goal model, it is possible to identify which objectives or tasks that has already completed or were not implemented by the end of the time allocated for the implementation of the required actions. Our focus is to find out why strategic procurement plans were not fully implemented as intended.

In order to assess the degree of strategic plan implementation, evaluation of the strategic plan need to be carried out. Interviews were done to validate the implementation of strategic plan. From this exercise, it is noted that there are some tactic/tasks that are being carried out, however, are not able to meet the objectives stated. There are also some changes in strategies, thus different tactic/task were carried out compared to the written strategy.

Our key contributions for RQ2 are:

1. VMOST-type modelling which analyses the alignment organisational processes and actual business goals is a useful tool in measuring sustainability – if the organisation has identified that as a goal.
2. This research was pioneering in its use of VMOST/B-SCP in the following ways:
  - It examined a business change while it was actually taking place rather than after it had been completed (need to accommodate changes in objectives and strategies).
  - It analysed a system that had some IT support but where human-operated procedures predominated.
  - The base data came from a strategy document that focused on implementation activities to be carried out rather than functionality to be implemented.
  - Original B-SCP used Jackson's (2001) problem frames which focused on possible software components – in our scenario SNA inspired actor diagrams were found to be more appropriate.
3. Most of the changes to the strategy occurred where external entities that the change programme depended on did not act as planned. The actor networks produced in our version of VMOST/B-SCP can be used to identify such risk.

### **7.3 Research Limitations**

The original aspiration of the research was to use social network analysis (SNA) techniques to help in the creation of ‘green’ supply chains (refer Section 3.7). Studying complete supply chains was found to be over-ambitious so the focus moved to the interface between supply chains and the organisations they supply, that is the organisational procurement process. The initial focus became IT procurement in the HE sector, simply in order to make the investigation manageable. It was clear that making procurement green required much more information/knowledge to be applied than had previously been the case. There was a movement from a focus on individual information systems embedded in organisations to information infrastructures where information had to be obtained from a range of sources, both internal and external to an organisation.

It was found that a limitation of SNA for our purposes was that it assumed that the network it analysed was homogeneous, that is, that the nodes (in this case, actors) and the messages passed between were uniform in structure and purpose (refer Section 3.8). In fact, the systems examined were heterogeneous actors (e.g. individuals, organisations and even non-human systems) and the types of relationship between them could vary accordingly. Another challenge was that where there were similar actors, in a structured, hierarchical, organisation these actors might not form networks with each other. A member of staff in one department who has to buy stationery does not have to talk to stationery buyers in other departments. This would particularly be the case where procurement is only a small part of a person’s role. It was also found that staff tended to delegate ‘sustainable’ judgement to experts, that is, they treated sustainable procurement decision making as a ‘black box’ located externally. For example, Information Services depends on the framework agreement supplied by SUPC so that sustainability issues seemed to be effectively outsourced to SUPC.

Despite all the factors tending to make for very weak networks, it was possible to map out the main processes involved in procurement and the types of information that were used (refer Section 4.2).

Another challenge that emerged was that the study organisation intended to transform their procurement processes to make them more 'sustainable', and a strategy that had been developed to implement these changes. The research took account of this dynamic situation by applying a goal modelling approach, where influence diagrams showing the relationship between various planned practical activities and the hoped for organisational objectives could be mapped (refer Section 6.3)

Much of the goal modelling that had previously been studied in IT setting has been concerned with ensuring that the new systems that resulted from the changes would support the business objectives. In the case of the study organisation, the focus of the strategy was on the change actions to be taken, rather the nature of the final systems (it was an action plan rather than a system design). The research therefore looked at ways of adapting the methodology to cope for the two dimensions.

We can see that many of the planned actions have not actually been completed – usually because of costs (refer Section 6.5.4). It can also be seen that some of the actions that were taken were not successful in achieving their outcomes. The goal models can be modified to take account of these variations and the impact that they have had on the broader fulfilment of organisational outcomes.

It is clear that terms such as 'green' and to a greater extent, 'sustainable', in practical terms relate to complex situations that can be subject to a range of interpretations. There are issues about combining judgements about possibly conflicting sustainability criteria. For example, 'sustainable' IT systems are seen as ones where the system itself is accepted and long-lasting. This seems to have little to do with 'greenness'. To deal with this



situation, one of the ways is the processes involved in decision making. It is important to explore the implications, regulations and procedures. Another way is by having interconnections with other agencies, stakeholders or other relevant external parties. Following this concern, it is clear to say that information model produced in this study is very relevant to support decision making by procurement staff in making an informed sustainable procurement.

#### **7.4 Research Contributions/Conclusions**

From this research, we can conclude:

- a. The carbon reduction plan introduced by HEFCE to be implemented in UK Higher Education Institutes is the basis of this research (refer Section 1.1). In UoB carbon reduction plan, they tried to reduce the carbon emission mostly from procurement process. This led to the formulation of the UoB carbon reduction plan in which procurement was a major element. So, this situation has motivated us to investigate ways to help procurement people to make an informed procurement decision. While information to be considered to make informed procurement decision already exists, this information was dispersed and needed integration.
- b. Prior to inadequate research on information architecture in sustainable procurement, the development of information model to consider types of information needed to make informed decision of sustainable procurement can be consider as new findings in sustainability research. This model considers internal and external information of the organisation. The information used in the model already exists but were put in different places. The large number of

potential information sources makes it impractical to store all the information in a database (Refer Section 4.7).

- c. Initially, the use of social network analysis (SNA) was to map all the stakeholders involved in procurement process. SNA diagrams were based on interviewing using a 'snow-balling' approach. We then decided to change the diagram name to actor network diagram because it seems that other functions of SNA were not related to this research and not utilised. The actor network diagram was then used as integration with B-SCP to identify its context (refer Section 6.6 ).
- d. The findings on goal model show that a goal model is not static and it changes as external circumstances and organisational priorities change (refer Section 6.5). The Seven-Eleven (S-E) analysis by Bleistein et al. (2005) is a static model and does not take account of the changing nature of strategies and their implementation. A simple example of this is that a technological development may cause a strategy/tactic to be modified as happened in the UoB scenario with the adoption of Sharepoint. Objectives are more likely to remain unchanged. A task may fail to achieve an objective, but the organisation can still want to meet that objective. Goal mapping is a form of cognitive causal mapping (Chaib-draa, 2002). Causal links between events are always subject to a degree of 'error' stemming from random influences in the environment. Unlike goal mapping, causal mapping also takes account of negative influences that may constrain achieving a goal, such as competition from rivals. After the event analyses can be accurate and detailed (e.g. what exactly happened in a battle), while effective predictive models need to be more simple.

- e. The implication of the changes in goal model is good because it mapped the real situation that the organisation is facing. The goal model initially mapped and based on the UoB was produced before the implementation activities were started. To compare this scenario, S-E was analytical and looks at a system post-implementation. It was a snapshot in time and at a time when all the uncertainties in the system had been resolved. The UoB was predictive and was produced before implementation activities were started. However, they both involve purchasing but from a very different viewpoint.
- f. There is concept variable for strategies to do with depth. A deep strategy is one where there is a single application of a technology like building a nuclear power station where there are lots of interdependent strategies and tasks all contributing to one outcome. Shallow strategies (or perhaps 'policies') have an accumulation of smaller outcomes that can be achieved incrementally. They are often characterised by the relatively simple technological support they require. S-E seems deeper in this sense than the UoB. It might be expected that shallow (but broad) programmes would have more tactics/tasks (of a smaller size) but fewer dependencies between those tasks.
- g. The S-E strategy focused on requirements while the UoB scenario focused on actions. This was simply because of the nature of the data available. While elements of both requirements and implementation planning are needed for successful programmes, it would suggest the lack of attention to important aspects of the new procedures led to a degree of non-compliance by users. Central procurement officers certainly complained about this. One aspect of the use of IT systems to carry out tasks is that they can enforce compliance. If you want a new laptop then you have to use the IT system to purchase it and

you have to comply with its demands for information and permissions. In the UoB scenario the procedures were in the form of printed documents guiding manual clerical procedures with the assumption clerical staff would follow them. This suggests that there is a risk that over time staff might drift away from practices that they find inconvenient. There is a need for the design of 'sustainable' practices that will survive over time. A requirements-focused approach like S-E may be better placed to do this.

Among the reasons for the non-completion of tasks were:

1. Resources not made available by UoB central finance
2. Lack of success in contacting external bodies
3. Lack of compliance/ co-operation with UoB schools and departments
4. Changes in strategies implementation

These reasons all stem from assumptions about the behaviour of external actors being incorrect. This shows the value of the context diagram as success depends on each actor in the context acting according to expectations. As a conclusion, the approach of using B-SCP is differed from that adopted by Bleistein et al. (2005). While the concept of context diagram is good enough to evaluate the UoB procurement strategy, we still integrate context diagram with actor network diagram to identify the key stakeholders. The integration of actor network diagram and B-SCP in this research context could help in verifying the actors that are identified from procurement process that lead to the development of information model and the ones identified from B-SCP context domain.

Apart from integration with actor network diagram, the way B-SCP is applied to this research context is different from Jackson (2001). The concept of central machine is not applied here because it was difficult to identify a central 'machine' that would provide

the information needed to make informed buying decisions. The information needed would need to come from a range of different sources. Finally, this approach was implemented to evaluate the change plan of a future system which is different from Bleistein et al. (2006b) who evaluated the existing system.

It is clear from the comparison of the actor network diagram for the procurement process that was studied in Chapters 4 and 5 and those that were produced for the B-SCP analysis of the UoB strategy that these actually relate to two different (but linked) systems (i) a system to procure products that would comply with environmentally sustainable criteria (ii) a system to manage the overall university procurement. It could be argued that (ii) is needed in order to enable (i). The first is focused on schools and departments that are the responsibility of the budget holders, and the second on the central procurement office. The new 2015 procurement strategy document suggests that lessons have been learnt and more is made of engagement with schools, etc.

## **7.5 Possible Future Work**

Several possible research directions have emerged. As our initial plan was to investigate the green supply chain, it is suggested that the information model could be developed to cater for the whole supply chain. The information model could help in making informed decisions starting from deciding on the raw materials through to the product disposal.

This research also can be carried out to investigate sustainable procurement process in other public sector. As we know, the scope of this research is universities in UK. Future work is suggested to cater other public bodies such as council or health sector. It also would be of interest to see if the external actors with whom there have been negative outcomes were identified in the relevant actor network diagram. If they have not it might suggest greater scrutiny of potentially dysfunctional actors is needed.

Another possible area of future work is to analyse all parts of the UoB strategy to see if a more general strategy could be identified that includes such things as a general drive to document standards, centralise control, improve communication, etc. This might create a more in-depth study.

## **7.6 Chapter Summary**

In this chapter, despite the differences between the Seven-Eleven (S-E) case and our case of the University of Brighton (UoB), what can be concluded was the extent to which most of the techniques involved were transferable. Moreover, we tried to improve the way in which the goal context was identified by integrating another technique, namely, social network analysis (SNA), to produce an actor network diagram. It appears that this goal modelling technique could improve the way that the organisation pictures its strategy document as this technique helps in linking the related goals, objectives and tasks.

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## APPENDICES

### APPENDIX A – INTERVIEW PROTOCOL FOR PROCUREMENT NETWORK

#### Interview protocol (purchasing group)

Interviewee:

Department:

Hello good morning/afternoon/evening, first of all thank you for willing to be here today.

I am Emelia, a PhD student working on a research related to Sustainability in UOB.

Before we start, I would like to let you know that I am going to record this interview for my own reference later and will not be shown to anybody else except for my supervisors.

So, my questions are:

- a) What do you buy and who are your suppliers?
- b) For whom do you buy ?
- c) Who approves the order?
- d) Do you have freedom on any product you want to buy?
- e) How do you select your suppliers and product type?
- f) How do you get information about your suppliers?
- g) Do you interact with your suppliers?
- h) If NO:
  - a. How do you place order from suppliers?
- i) If YES:
  - a. How often do you interact with your suppliers?
  - b. Why do you interact with them?
  - c. How do you interact with them?
  - d. Who are they?
- j) Have you ever received any complaint with particular orders?
- k) If YES:
  - a. Do you share them with the suppliers?
  - b. Do you share them with your colleague?
- l) Do you have any problem with the process?

- m) If YES:
  - a. Do you share them with your colleague?
- n) Do you interact with your colleagues about your work?
- o) If YES:
  - a. Who are they?
  - b. Why do you interact with them?
  - c. How often?
  - d. How do you interact with them?



## **APPENDIX B – INTERVIEW PROTOCOL FOR SUSTAINABILITY NETWORK IN UoB**

Interviewee:

Department:

Hello good morning/afternoon/evening, first of all thank you for willing to be here today.

I am Emelia, a PhD student working on a research related to Sustainability in UoB.

Before we start, I would like to let you know that I am going to record this interview for my own reference later and will not be shown to anybody else except for my supervisors.

So, my questions are:

- 1) What is your role within the university?
- 2) How do green/sustainability issues affect your work?
- 3) How do you define sustainability in UoB?
- 4) Do you have any particular interest of sustainability in UoB?
- 5) Are you involved or have any influence in sustainable practice policy?
- 6) What is your involvement in sustainability policy group?
- 7) What aspect of sustainability policy you concern with?
- 8) Do you have any personal aim/objective regarding to sustainability?
- 9) Do you interact with other people to discuss or share any sustainability issue?
- 10) If YES:
  - a. Who are they?
  - b. What do you talk about with them?
  - c. How do you interact with them?
  - d. How often? (daily, weekly, monthly?)
- 11) What are the sources of information related to sustainability that you have?  
Books, meetings, etc.? What books/website?
- 12) Do you belong to any sustainability group outside the university?
- 13) Do you know other people that might be interested in sustainability in UoB?

**If at any point, somebody else's name is referred:**

- 1) You just mentioned [name], who are they?
- 2) How do you know them?

- 3) Can you give me their contact?
- 4) What do you talk about with them – with regard to sustainability issue?
- 5) How do you interact with them?
- 6) How often? (daily, weekly, monthly?)

## APPENDIX C – INTERVIEW PROTOCOL FOR UoB

1. What is your role in the university?
2. What are the criteria of suppliers you are looking for in terms of sustainability?
3. Do you use any specific system to place orders? How do staff place orders?
4. Do you use e-tendering system?
5. Do staff refer to IT department when they want to buy IT equipment?
6. What are the processes of IT procurement - starting from staff placing orders?
7. Are there any guidelines available for IT procurement?
8. Is information such as sustainable product criteria available to staff?
9. Where do staff who want to purchase IT equipment refer to select sustainable product?
10. Since you are a member of buying consortia and using their framework agreement to purchase, do you still have your own sustainable criteria when purchasing products?
11. Who is responsible to create list of sustainable product criteria?
12. Other than suppliers listed by framework agreement, do you have your own list of suppliers?
13. How do you select the most sustainable product criteria?
14. Do staff aware of sustainability especially when they want to procure things?
15. Do they need advice when purchasing IT equipment?
16. Who they refer to for advice on green criteria?
17. Do you assess your suppliers?
18. Are you involved directly with SUPC and other members in e.g. setting up the framework or any other process?
19. How do you update your knowledge in sustainability
20. Can you please recommend me other contacts that are involved in sustainable procurement?

## APPENDIX D – PQQ SAMPLE FOR SUPPLIER SELECTION

### Supplier Selection

The objective of the selection process is to assess the responses to the Pre-Qualification Questionnaire and select potential suppliers to proceed to the next stage of the procurement.

Selection criteria will be a combination of both financial and non-financial factors and will consider:

Supplier Acceptability – status of supplier (in relation to Regulation 23(4) of the Public Contracts Regulations 2006 (SI 2006 No 5)). A summary of Regulation 23 (4) is included in Section 4.

Economic and Financial Standing – the supplier must be in a sound financial position to participate in a procurement of this size as set out in Regulation 24 of the Public Contracts Regulations 2006 (SI 2006 No 5). This may entail independent financial checks.

Supplier Track Record - The supplier must be able to demonstrate a successful track record of providing similar services to those listed in the Official Journal of the European Union (OJEU) notice as set out in Regulation 25 of the Public Services Contracts Regulations 2006 (SI 2006 No. 5).

Supplier capacity and capability – Assessment of the totality of resources and core competences available to the supplier(s) in the delivery of this service.

Failure to provide a satisfactory response to any of the questions may result in EHU not proceeding further with the applicant.

The information supplied will be checked for completeness and compliance before responses are evaluated.

The PQQ submission will be evaluated as follows:

Section number of Pre Qualification Questionnaire	Weight	Max. Score Available
Section 3.1 Organisation Details	1	1
Section 3.2 Insurance	IN/OUT	
Section 3.3 Compliance with EU Legislation/UK Procurement Legislation	IN/OUT	
Section 3.4 Quality Assurance	4	8
Section 3.5 Financial	IN/OUT	
Section 3.6 References	3	6
Section 3.7 Disputes	3	3
Section 3.8 Business Capability	4	8
Section 3.9 Capacity and Technical	4	8
Section 3.12 Terms and Conditions of Contract	5	10

### Weighting

Weightings are from 1 to 5 and reflect the level of priority EHU attach to the requirements, 5 being the highest.

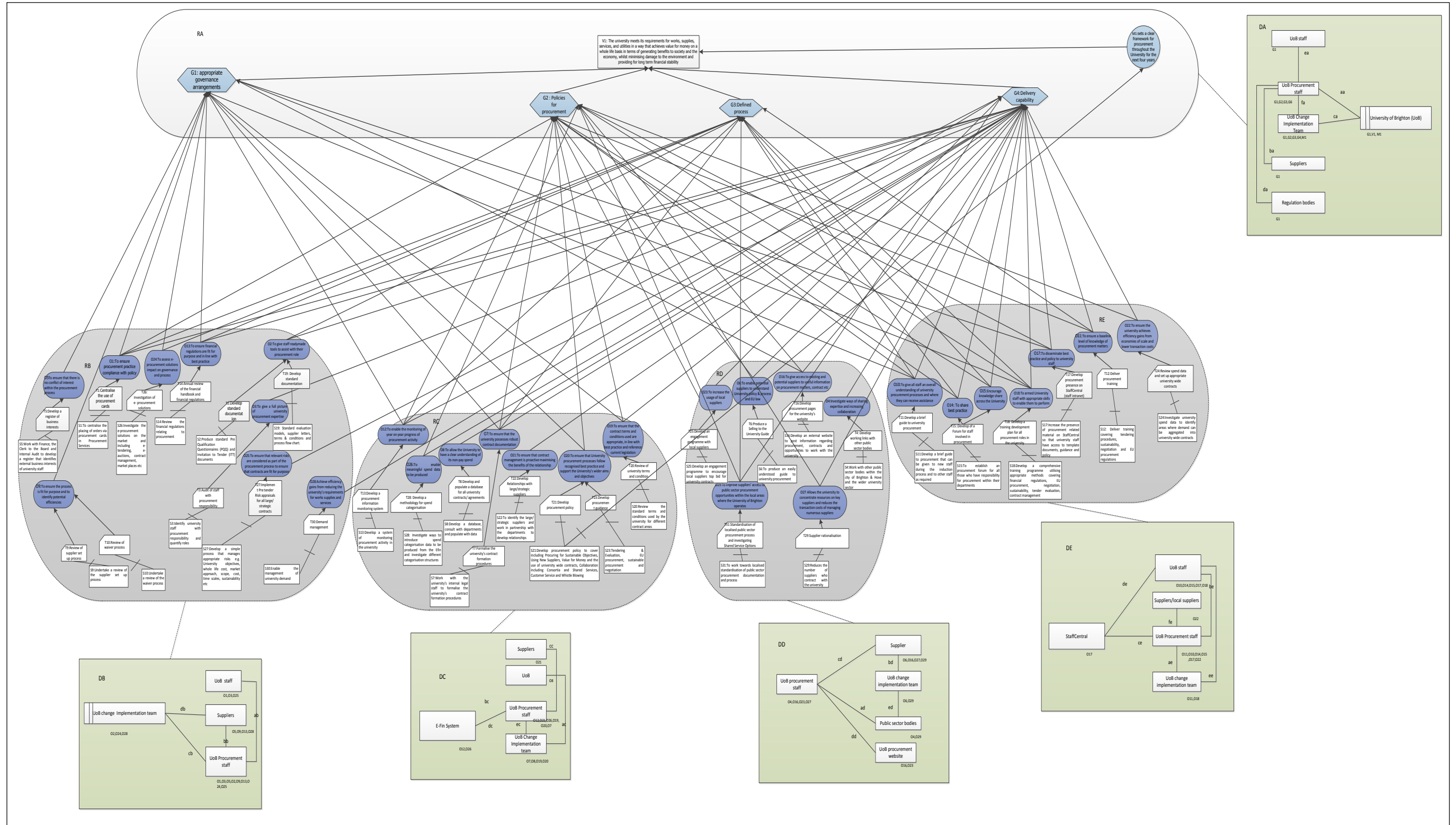
**IN/OUT** Questions are perceived as mission-critical requirements, and thus will not attract a score or weighting, but will determine whether a tenderer remains in the process.

### Scoring

Guidance on scoring is provided in each section.

EHU intends to award any contract based on the most economically advantageous offer.

# APPENDIX E – UoB PROCUREMENT STRATEGY GOAL MODEL



# APPENDIX F – VALIDATED UoB PROCUREMENT STRATEGY

