

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.



Achieving Procurement Cost Efficiencies in a New Zealand Telecommunication Company

-

An Exploratory Study

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Applied Science

in

Logistics and Supply Chain Management

at Massey University, Palmerston North

New Zealand.

Jayshree Ravi

2010

Supervised by: Dr. Norman Marr

This page intentionally left blank

Abstract

The purchasing function in supply chain management contributes directly to the operating results and profitability of an organization. The fact that purchasing spend of an organisation is over half of its revenue highlights its potential.

Supply Chain Management addresses many aspects of a business, and it can be even more complex for a telecommunication organisation where both goods and services play a key role.

This research utilised a single case study to investigate pathways to achieving procurement cost efficiencies. The current supply chain literature was used to assess the supply chain of a telecommunication organisation with a view to quickly identify opportunities for improvement.

The research explored a number of topics as described below.

- The processes in the procurement cycle, namely Forecast, Source, Order, Pay and Review. This was used to assess the procurement process maturity and recommendations for improvement were made.
- Understanding the procurement spend is a key requirement for the development of a procurement strategy. This is typically performed by category. However this is a difficult task for most organisations. This study showed how a spend analysis and category management system can be designed and implemented. It also showed how this can be used in conjunction with a purchasing portfolio matrix to quickly focus on spend categories that would provide maximum benefit.
- Research has shown that Information technology is a key enabler in the supply chain. This study also highlighted how the current SAP ERP system and E-procurement can be leveraged in the current context to obtain process and cost benefits.
- Measurement of procurement performance is an important aspect for any process improvement exercise. The study identified relevant performance measures for supplier as well as payment performance.

- The research also showed how the SCOR model can be used to provide an overview of the supply chain and the importance of calculating some key SCOR metrics to assess opportunities for improvements.

The study revealed that a number of options are available for procurement cost reduction. It also highlights the importance of process compliance and integration with other aspects of the supply chain (especially forecasting) to exploit opportunities for cost reduction.

Acknowledgements

I would like to express my sincere gratitude to Dr. Norman Marr, my supervisor. His guidance, enthusiastic support and the advice throughout this research project has been invaluable.

I would like to thank Peter Guard, Telecom New Zealand for providing me with the opportunity of studying the procurement processes and working on a number of opportunities in the procurement transformation project (Category Management, Spend Analysis, Asset Lifecycle Management) that contributed to this research project. Thanks also to Cynthia Mathonsi, Neil Ritchie, Simon Mason and Sandra Beddis at Telecom for patiently answering my questions.

I would also like to thank Alan Win (Massey University, Auckland) for convincing me to embark on the Masters Programme and Kathy Hamilton (Massey University, Palmerston North) for assisting with the enrolment.

Thanks are also due to my employer Soltius New Zealand for permitting me to spend my downtime on completing this study. In particular, I would like to express appreciation for my colleague Siow Fong Chen with whom I have had endless discussions on procurement systems.

I am extremely grateful to my husband Ravi who has been my mentor, friend and critic and provided me with a lot of insight and guidance in this work. A big thank you to my daughters Shrividya and Vijayanthi, my mother Leela and my parents-in-law Meenakshi & Balasubramanian for putting up with my expositions and supporting me during this long process.

Finally I would like to dedicate this work to my late father, Krishna Iyer who has moulded me into what I am today and motivated me to do my best.

Jayshree

Table of Contents

Abstract.....	i
Acknowledgements	iii
Table of Contents	iv
List of Figures	x
List of Tables	xiii
Glossary	xv
Chapter 1. Introduction	1
<hr/>	
1.1 INTRODUCTION.....	1
1.2 BACKGROUND	1
1.3 COMPANY BACKGROUND	2
1.3.1 The Networks business	5
1.4 RESEARCH OBJECTIVES.....	5
1.4.1 Why focus on purchasing & supply management?.....	6
1.4.2 Research Question	7
1.4.3 Scope.....	8
1.4.4 Limitations	9
1.5 THESIS SUMMARY	9
Chapter 2. Industry	11
<hr/>	
2.1 INTRODUCTION.....	11
2.2 WORLD TELECOMS	11
2.3 NZ TELECOMS	12
2.4 THE TELECOMMUNICATION SUPPLY CHAIN.....	14

2.4.1	Why is a telecom supply chain different?.....	14
2.4.2	Fixed Networks	17
2.5	SUPPLY CHAINS IN NEW ZEALAND	18
2.6	SUMMARY	19
Chapter 3. Literature Review		21
<hr/>		
3.1	INTRODUCTION	21
3.2	SUPPLY CHAIN MANAGEMENT	23
3.2.1	SCM definitions	23
3.2.2	Service Supply Chains.....	25
3.2.3	Supply Chain Boundaries.....	27
3.2.4	Supply Chain Maturity.....	30
3.3	MODELLING THE SUPPLY CHAIN.....	31
3.3.1	Why a supply chain model?	32
3.3.2	The SCOR model.....	33
3.3.3	Supply Chain Performance Metrics	36
3.3.4	Factors to Consider	40
3.3.5	A Revised SCOR model for Telecoms.....	41
3.4	PURCHASING AND SUPPLY MANAGEMENT	44
3.4.1	Introduction.....	44
3.4.2	Supply Management.....	45
3.4.3	Procurement Processes	46
3.4.4	Purchasing Portfolio	49
3.4.5	A Portfolio for Services Procurement.....	54
3.4.6	Supply Market Complexity.....	54

3.5	ACHIEVING PROCUREMENT EXCELLENCE	57
3.5.1	Importance of good procurement practices	57
3.5.2	Procurement Maturity	60
3.5.3	Category Management	61
3.5.4	Spend Analysis.....	65
3.6	LEVERAGING INFORMATION TECHNOLOGY.....	68
3.6.1	Information Technology Opportunities.....	68
3.6.2	Impact of Information Technology on Performance	71
3.6.3	E-Procurement.....	74
3.7	SUPPLIER MANAGEMENT	81
3.7.1	Supplier Relationships	81
3.7.2	Supplier Performance	84
3.8	SUMMARY.....	88
3.9	LITERATURE AND CURRENT STUDY	89
Chapter 4. Research Methodology.....		91
<hr/>		
4.1	INTRODUCTION.....	91
4.2	RESEARCH OBJECTIVES	91
4.3	THE RESEARCH PROCESS	92
4.3.1	Overview.....	92
4.3.2	Research Philosophy.....	93
4.3.3	Research Approach	96
4.3.4	Research Strategies	96
4.3.5	Research Choices	103
4.3.6	Time horizon	103

4.3.7	Data Collection.....	104
4.4	ETHICAL ISSUES.....	105
4.5	CHOICE OF METHODOLOGY	106
4.5.1	Summary.....	108
Chapter 5. Analysis and Discussion		109
<hr/>		
5.1	INTRODUCTION	109
5.2	PURCHASING AND SUPPLY MANAGEMENT	109
5.2.1	Purchasing Organisation in Telecom	109
5.2.2	Process and Systems Overview.....	111
5.2.3	Forecast.....	112
5.2.4	Source	113
5.2.5	Purchase	116
5.2.6	Pay.....	118
5.2.7	Review.....	120
5.2.8	Purchasing Process Maturity.....	122
5.2.9	Recommendations for improving process efficiencies.....	122
5.3	IMPLEMENTING CATEGORY MANAGEMENT AND SPEND ANALYSIS.....	125
5.3.1	Approach.....	125
5.3.2	Spend Analysis System Design.....	126
5.3.3	Benefits of Spend Analysis.....	130
5.3.4	Category Architecture	131
5.4	ANALYSIS OF SPEND DATA	131
5.4.1	Purchasing Spend as a percentage of revenue	131
5.4.2	Spend by Business Unit	132

5.4.3	Spend by Currency.....	132
5.4.4	Spend by Vendor.....	133
5.4.5	Spend by Category.....	133
5.4.6	Kraljic Portfolio Analysis.....	139
5.5	SUPPLY PERFORMANCE.....	143
5.5.1	Shortlisted performance metrics.....	143
5.5.2	Delivery Performance Summary.....	146
5.5.3	Payment Analysis.....	151
5.5.4	Future Opportunities.....	153
5.6	INFORMATION TECHNOLOGY.....	154
5.6.1	Current use of IT in Procurement at Telecom.....	154
5.6.2	Purchasing Document Analysis.....	158
5.6.3	Opportunities for leveraging Information Technology.....	162
5.6.4	E-Procurement Strategy.....	166
5.6.5	IT Systems Maturity.....	172
5.7	SUPPLY CHAIN ANALYSIS.....	173
5.7.1	Overview.....	174
5.7.2	Material Flow.....	175
5.7.3	Thread Diagram.....	179
5.7.4	Supply Chain Performance.....	184
5.7.5	Cash to Cash Cycle Time.....	189
5.7.6	Supply Chain Maturity.....	191
Chapter 6. Conclusion.....		193
<hr/>		
6.1	INTRODUCTION.....	193

6.2	OVERALL OBJECTIVE	193
6.3	OBJECTIVE 1 – PROCUREMENT PROCESS REVIEW	194
6.4	OBJECTIVE 2 – SPEND PATTERNS FOR SUPPLIER BASE ANALYSIS.....	196
6.5	OBJECTIVE 3 – PERFORMANCE MEASUREMENT	197
6.6	OBJECTIVE 4 – LEVERAGE IT FOR COST REDUCTION.....	198
6.7	OBJECTIVE 5 – SUPPLY CHAIN MODELLING AND ANALYSIS	200
6.8	LIMITATIONS	200
6.9	FUTURE RESEARCH.....	201
	References.....	203
	APPENDICES.....	214
	Appendix A – Category Architecture	214
	Appendix B – Non-Disclosure Agreement	218

List of Figures

Figure 1.1: Telecom Organisation Structure	4
Figure 1.2: Research Outline	10
Figure 2.1: A traditional supply chain.....	15
Figure 2.2: A telecom supply chain	15
Figure 2.3: Telecom NZ Supply Chain Schematic.....	16
Figure 2.4: Telecom NZ Supply Chain model.....	16
Figure 2.5: Example of a Fixed Network.....	18
Figure 3.1: Literature Review – Topics Covered.....	22
Figure 3.2: Inter-company links	28
Figure 3.3: SCM Process.....	29
Figure 3.4: Supply Chain Maturity.....	30
Figure 3.5: The SCOR Model.....	34
Figure 3.6: SCOR Metrics	37
Figure 3.7: Cash to Cash cycle time	39
Figure 3.8: Revised SCOR model	43
Figure 3.9: Purchasing Process Model.....	47
Figure 3.10: A Typical Purchase Order Cycle.....	48
Figure 3.11: Purchasing Portfolio Model	50
Figure 3.12: Overview of purchasing strategies	53
Figure 3.13: Classification of business services	54
Figure 3.14: Supply and Demand Power	55
Figure 3.15: The Purchasing Chessboard	56

Figure 3.16: The purchasing spend cube.....	66
Figure 3.17: Typical IS infrastructure for SCM.....	69
Figure 3.18: Linking Processes and IT Systems.....	72
Figure 3.19: E-procurement goals and examples.....	77
Figure 3.20: Impact of E-Procurement.....	79
Figure 3.21: E-Procurement Options	81
Figure 3.22: Impact of Supplier Relationship on EVA.....	82
Figure 4.1: The Research Onion.....	92
Figure 4.2: Research Choices.....	108
Figure 5.1: Categorising Purchases.....	127
Figure 5.2: Material Group in SAP	128
Figure 5.3: Invoice Overview	128
Figure 5.4: Invoice with GL Code.....	129
Figure 5.5: Associating vendors with categories.....	130
Figure 5.6: Kraljic Portfolio Analysis.....	139
Figure 5.7: Kraljic Portfolio (Revised)	143
Figure 5.8: PO Delivery Statistics	147
Figure 5.9: Example Supplier Scorecard	154
Figure 5.10: Electronic Supplier Interaction	157
Figure 5.11: Electronic Communication with Supplier.....	158
Figure 5.12: Elements of E-Procurement	169
Figure 5.13: E-Procurement selection considerations.....	170
Figure 5.14: ISAM in a roadside cabinet	175
Figure 5.15: Fixed Network Process Overview.....	176

Figure 5.16: Material Flow (Initial Build) 177

Figure 5.17: Material Flow (Subsequent Expansion) 178

Figure 5.18: Material Flow (Return and Repair) 179

Figure 5.19: SCOR Thread Diagram (AS-IS) 182

Figure 5.20: SCOR Thread Diagram (TO-BE)..... 183

Figure 5.21: Performance metrics measured 185

Figure 5.22: Installation Times (No. of Cards) 188

Figure 5.23: Goods Receipt Delay..... 189

Figure 6.1: Areas covered by study 194

List of Tables

Table 2.1: New Zealand Telecom Market Data	14
Table 3.1: Spend Classification	63
Table 3.2: Summary of E-Procurement Models	76
Table 4.1: The Research Onion Layers.....	106
Table 5.1: Spend by business unit	132
Table 5.2: Spend by Currency	132
Table 5.3: Spend by Category Level 1.....	133
Table 5.4: Spend by Category Level 2.....	134
Table 5.5: Categories and no. of suppliers	138
Table 5.6: Procurement Process Metrics	143
Table 5.7: Delivery Time by Category (Days)	147
Table 5.8: Payment Analysis by Amount.....	152
Table 5.9: Payment Analysis by Invoice Volume	153
Table 5.10: Invoice Analysis by Supplier.....	159
Table 5.11: Invoices with material number	161
Table 5.12: Spend by PO Type	161
Table 5.13: Streamlining R/3 purchasing process	164
Table 5.14: Streamlining SRM purchasing process.....	165
Table 5.15: Streamlining the payment process.....	165
Table 5.16: E-Procurement options by process	167
Table 5.17: IT Systems Maturity	172
Table 5.18: Supply Chain Definition Matrix.....	174

Table 5.19: SCOR Level 2 Processes 179

Table 5.20: Fixed Network Delivery Statistics..... 185

Glossary

Term	Description
APS	Advanced Planning Systems
Catalog	A list of items that can be purchased from a supplier. Includes item details and price.
COGS	Cost of Goods Sold
CPFR	Collaborative Planning, Forecasting and Replenishment
GPO	Group Purchasing Officer – The Head of the Procurement function
EDI	Electronic Data Interchange. The computer-to-computer exchange of business data in a standardized format.
ERP	Enterprise Resource Planning. Large systems like SAP, Oracle
ERS	Evaluated Receipt Settlement or buyer-created invoices
Material Group	A logical grouping of similar items as defined in the SAP system
OCR	Optical Character Recognition
RFx	RFI, RFP, RFQ, Request for Information, Proposal, Quotation etc.
S&OP	Sales and Operations Planning
SAP R/3	The core SAP ERP transactional system.
SAP SRM	Supplier Relationship Management. Part of the SAP suite of applications.
SCM	Supply Chain Management

Term	Description
SCOR	Supply Chain Operating Reference - from Supply Chain Council
SKU	Stock-keeping Unit. Also known as Material number in SAP
TCO	Total Cost of Ownership
UFB	Ultra-Fast Broadband
VMI	Vendor Managed Inventory

Chapter 1. Introduction

1.1 Introduction

The purpose of this chapter is to introduce the research topic, provide a general overview of the organisation and the relevance of the research. The objectives of the research are then built up. Finally, the outline of the thesis is presented.

1.2 Background

The primary goal of any business (except perhaps government and charitable organisations) is to increase net profit while simultaneously increasing return on investment and cash flow, or basically to make money (Goldratt & Cox 1992). All other objectives are secondary. Making money or maximising ROI can be achieved by increasing sales or reducing costs or a combination of the two.

The focus of this research is on identification of opportunities for cost reduction and performance improvement in the purchasing and logistics functions of the “fixed networks” business unit at Telecom NZ. It does not specifically cover any customer facing aspects.

Every organisation would like to cut costs but care must be taken to ensure that there is no impact on productivity or sales. This becomes even more important in the face of a global recession where every cent counts.

One of the key challenges faced by many organisations is cost visibility and measurement of performance metrics that will then enable them to hone in on the areas that need attention. This is corroborated with the author’s experiences in many leading organisations in NZ and India. It has also featured as a hot topic in a number of articles, books and conferences e.g. SAP Supply Chain.

1.3 Company Background

Telecom NZ Ltd is New Zealand's leading telecommunications and IT services provider. It provides a wide range of telecommunication services to homes and businesses ranging from the common telephone network, mobile, to the high-end broadband and high speed private networks. In addition, the Gen-I business unit also provides IT services to many New Zealand organisations.

Telecom sources a variety of goods and services from a large number of suppliers. It ranges from indirect goods and services like stationery, travel, freight, warehousing to direct goods and services like telecommunication equipment, computer hardware, software, network installation. It is of utmost importance to ensure that the quality of products and the levels of service meet its requirements. The Telecom Group comprises principally of the following business units (Telecom 2010)

Telecom Retail



Telecom Retail is responsible for providing fixed line, mobile and internet services to consumers and the small/medium business market.

Gen-i



Gen-i provides converged technology and telecommunications solutions for Telecom's business customers across New Zealand and Australia. It has a team of more than 2,000 people who are among the most highly skilled and experienced ICT integrators in Australasia.

Chorus



Chorus is the operationally separate business unit managing Telecom's local access

network in New Zealand. Chorus also operates the national field services group and takes the lead on significant developments like access fibre and Telecom's cabinetisation programme, which will deliver high-speed broadband to New Zealanders in all towns with 500 lines or more.

Telecom Wholesale



Telecom Wholesale is an operationally separate business unit that delivers next generation wholesale network connectivity products to service providers throughout New Zealand. Its broadband, business data, voice and interconnect products give wholesale customers the foundation on which to build their own network or telecommunications services for their end-users.

AAPT



AAPT is Telecom's Australian subsidiary and is the third largest telecommunications provider in Australia. Telecom acquired PowerTel Limited in 2007 to enable AAPT to leverage its investment in service capability and bring more customers onto the combined access network

Telecom International



TNZI is a full PTT telecommunications provider. As a division of Telecom Corporation of New Zealand, it provides leading edge voice, data and mobile services across New Zealand and Australia. The company is the country's largest internet service provider.

TNZI's global voice business trades with over 200 voice customers/vendor relationships worldwide. They carry around two percent of all global voice traffic. That's five billion minutes per year. Since 1996, they have been one of the top 10 international carriers in the US. They were the first international carrier to operate

using our 214 licence in the US.

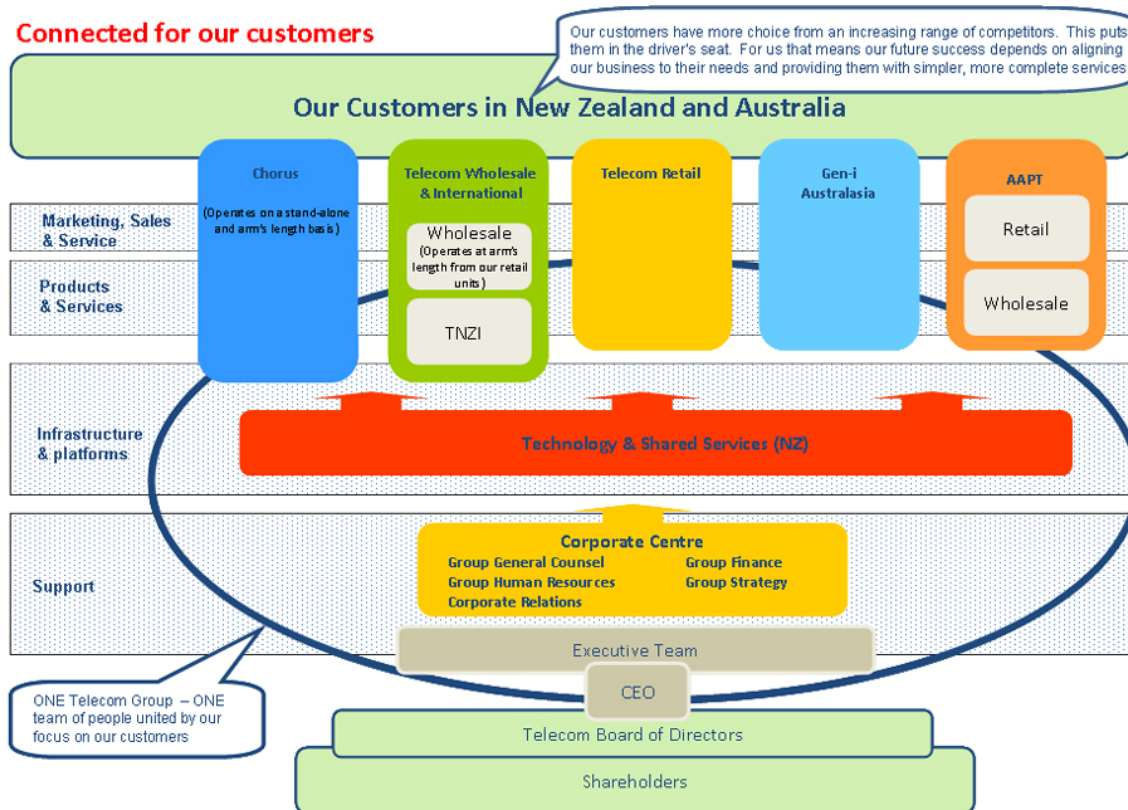
Technology and Shared Services

Technology & Shared Services maintains and develops all of Telecom’s New Zealand IT and network operations, ensuring Telecom’s transmission systems, network platforms and IT support systems and processes are aligned with the group’s business objectives. In addition to the core technology teams, the Shared Services function supports Telecom in areas such as accounts payable, procurement and supply chain, provisioning, billing, engineering, operations and information management.

Corporate Centre

Corporate Centre provides finance, communications, strategy, human resources and legal functions across Telecom.

Figure 1.1: Telecom Organisation Structure



Source: Telecom (2010)

Telecom's business units depicted in Figure 1.1 define how the company is organised. As part of the structure, there are:

- Five customer-facing business units – four in New Zealand (Chorus; Telecom Wholesale, including TNZI; Telecom Retail and Gen-i Australasia) and AAPT in Australia.
- A Technology and Shared Services (T&SS) business in New Zealand, creating the infrastructure and platforms for the company
- A Corporate Centre

In the year ending June 2008, it had an operating revenue of NZ\$5,673 million with a net earnings of NZ\$713 million. From a New Zealand perspective, the revenue was NZ\$ 4,225 million with an EBIT (Earnings before Interest and Tax) of NZ\$ 1,219 million. (Telecom 2009)

1.3.1 The Networks business

From a networks perspective, the Telecom Group provides a full range of Internet, Data, Voice, Mobile and Fixed Line calling services. It operates in NZ and Australia and has about 7,500 employees in NZ and 1,500 in Australia.

Key network statistics include

- Fixed Line Connections: 1.4 million
- Mobile Connections: 2.2 million
- Broadband Connections: 527,000

1.4 Research Objectives

The objective of this study is to identify avenues for efficiency and cost reduction in the supply chain from a procurement perspective for a New Zealand based telecommunications organisation.

To achieve this, the following preparatory steps are required

- Review the current procurement processes and identify avenues for efficiency gains
- Identify spend patterns to conduct effective supplier base analysis
- Explore how procurement performance is measured
- Leverage use of Information Technology to reduce costs
- Model and analyse the supply chain to assess the current state of performance.

The fixed networks business unit has been used as an example to achieve this.

1.4.1 Why focus on purchasing & supply management?

With globalisation and the freeing of international trade barriers, supply chains have become more extended and complex. Correspondingly, there has been a shift from a regional to a global supply base to take advantage of lower manufacturing costs and availability of technical skills. Most firms have worked diligently to improve those parts of the supply chain that are under their direct control (Trent 2007). He says that they have reached a point of diminishing return in optimising their internal processes. Thus, logically the next major source of improvements is in supply management.

It is estimated that 50% to 70% of an organization's total cost comes from external purchase of goods and services. The efficient flow of materials, supplies, and services at the right time and place streamlines the process and can thus significantly reduce cost. (ISM 2010).

Over the years, purchasing and supply management has evolved considerably. There is an increasing focus on this discipline from the business community. An effective and efficient purchasing and supply function can make a significant contribution to the results of a company. As a result, organisations need to channel their efforts into

moving away from the traditional methods and develop a more strategic role in the organisation. (Van Weele 2005).

There is considerable research in supply chain cost management as is evident from the number of research papers the author viewed. However this cannot be directly applied to the current problem being investigated due to the following factors.

- The telecommunication industry is a fast changing area and there is not enough research in this field from a supply chain perspective.
- It was found that most of the supply chain research is focussed on manufacturing or retail organisations. This view is based on the literature searches performed by the author. The supply chain at Telecom New Zealand is a mix of goods and services and hence is largely a service supply chain. There has not been much research conducted in this area. Just like manufacturing companies, service companies are also required to achieve efficiencies in order to be profitable.
- A significant proportion of supply chain research has been in sales, manufacturing, planning, forecasting and other customer focussed areas. Only recently has the importance of the procurement and its contribution in cost reduction been recognised.
- Telecom New Zealand in particular has a different structure as a result of the recent changes introduced by the Local Loop Unbundling.

The purchasing spend of the Telecom Group is very significant and constitutes over half of the revenue. Thus cost savings in this area can have key benefits and hence the focus on this topic for this research.

1.4.2 Research Question

The study can be achieved by the following research questions

- What are the key areas of procurement spend?
- What opportunities exist for reducing procurement costs?
- How can procurement process efficiencies be achieved?

- How is procurement performance measured?
- What is the scope for optimising inventory in the supply chain?
- How can information technology be used to reduce procurement costs?

It must be noted that other areas like personnel skills, training and development etc. also play a significant part in cost reduction and efficiency improvements. However they have not been considered in this study.

1.4.3 Scope

This research focuses on the process of identifying opportunities for cost savings in procurement. Initially a broad overview of procurement cost analysis is presented. Detailed analysis is then performed on data obtained from the fixed networks business.

The scope of this study includes the following

1. An overview of the current state obtained by
 - Describing the procurement processes
 - Providing visibility of procurement spend by categories
 - Assessing how performance is measured
 - Reviewing the usage of information technology
 - Describing the supply chain network for the “fixed network” business unit using relevant techniques like the SCOR model and detailed process diagrams.
2. There are a number of ways to reduce procurement costs. The following aspects are considered in this research to influence procurement costs and explored in more detail.
 - Category Management and Spend Analytics
 - Inventory Management
 - Information technology
 - Supplier relationships

- Procurement performance

Relevant metrics and data are analysed to arrive at the outcomes.

3. This is a vast area and only some aspects have been researched. Where possible, opportunities for future research are also discussed.

1.4.4 Limitations

This research focuses only on purchasing and supply management practices at one company in New Zealand and is based on a single case study. Therefore it may not be representative of the industry and cannot be generalized.

Also as mentioned earlier, only some aspects of cost reduction opportunities are considered. A number of areas like personnel skills, import costs, foreign currency analysis have not been taken into account. In addition, the planning, sales and reverse logistics aspects of the supply chain are also not part of this study.

1.5 Thesis Summary

The thesis is divided into seven chapters.

In this first chapter, an introduction is made to the background of the research, followed by the research objectives.

In the second chapter, an overview of the world and New Zealand telecommunication industry is provided and in particular with the company background relevant to this research.

In the third chapter, a literature review of relevant research within the overall area is provided with a view to serving as the theoretical basis of the study. Then the thesis purpose is presented and a general discussion on the theories and relevance to the research questions are formulated.

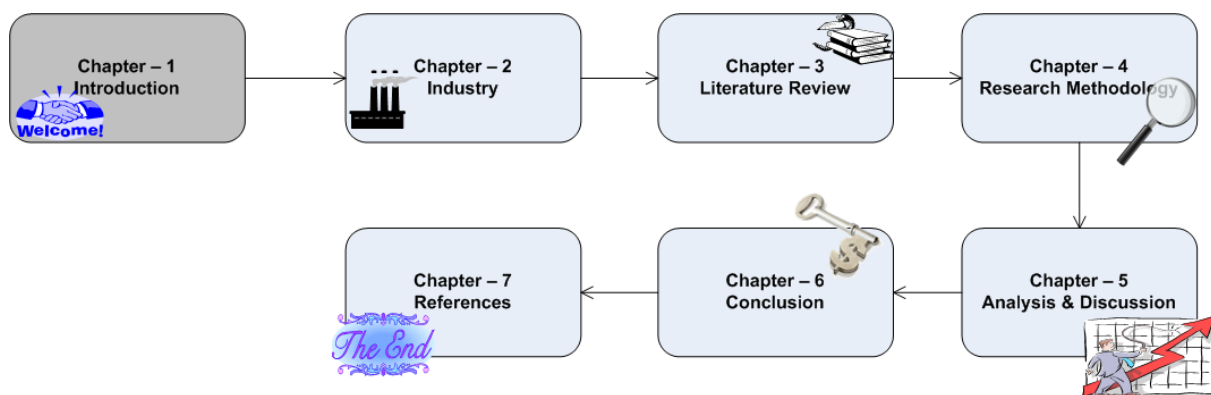
In the fourth chapter, the methodology used for this thesis viz. the case study is discussed.

The findings are presented and analysed in the fifth chapter.

The sixth chapter derives the appropriate conclusions and recommends areas of further research.

A schematic of the thesis is illustrated below in Figure 1.2.

Figure 1.2: Research Outline



Chapter 2. Industry

2.1 Introduction

In this chapter, the telecommunication industry is discussed from a global and NZ perspective. Aspects of the organisation relevant to this research are also described.

2.2 World Telecoms

The telecommunication industry is coming under severe pressure both from changing operator demands and new entrants in the form of IT and emerging Asian suppliers. This means that selling fixed and mobile network equipment is becoming even more challenging for manufacturers. (Insight 2008)

The key challenges faced by the telecommunications industry are:

- The telecommunication industry is capital intensive and requires a substantial investment in infrastructure.
- As is characteristic of the high-tech environment, the telecommunication industry is rapidly changing. To keep up with the latest trends and competition, there is a need to upgrade equipment very often.
- There is a strong requirement for servicing and maintenance.

Example statistics from the Global Integrated Telecommunication Services - Industry Profile by Data Monitor (2008) are listed below:

- Market Value
The global integrated telecommunication services market grew by 1% in 2007 to reach a value of \$527.3 billion.
- Market Value Forecast
In 2012, the market is forecast to have a value of \$563.1 billion, an increase of 6.8% since 2007.

- Market Volume

The market grew by 3.8% in 2007 to reach 1,107 million subscribers.

- Market Volume Forecast

In 2012, the market is forecast to have 1,343 million subscribers, an increase of 21.4% since 2007.

- Market Segmentation I

The voice only sector accounts for 66.1% of the market's global value.

- Market Segmentation II

The Americas is the largest integrated telecommunication services market, accounting for 42.5% of the global market's revenues.

- Market Share

AT&T Inc. is a leading company in the integrated telecommunication services market, holding a 12.1% share of the market's global value.

2.3 NZ Telecoms

The report from Market New Zealand (2010) says that the size and dynamics of the NZ telecommunications industry make it well placed to deliver cost effective solutions for the markets.

New Zealand's complementary time zone, 12 hours ahead of GMT, enables international companies to test new applications during the European and US night, speeding up delivery and minimising disruption.

New Zealand has a robust telecommunications infrastructure with 100% digital exchange network, high-capacity fibre optic communications links into Asia and US, and it also incorporates the latest wireless technology – GSM/HSPA, CDMA2000/HSPA and the upcoming LTE standard.

New Zealand companies are also creating specialised wireless applications which are in high demand in the international market. Mobile technology standards operate

alongside numerous fixed wireless networks operating in both the licensed and unlicensed spectrum.

On the GPS platform, New Zealand has vast expertise in creating solutions for niche markets such as marine and transport. An example of its success is Navman.

With a population of four million, New Zealand provides a well-defined test market of early technology adopters - compact but large enough to provide realistic results, a notable example being Vodafone. Some facts about the NZ telecommunication industry are given below (Market New Zealand 2010)

- The telecommunications services industry makes up a third of the total ICT sales.
- Telecommunications and wireless hardware and services are exported to more than 100 countries around the globe.
- Major markets include the US, Europe, Australia, South America and Asia, the Middle East being an emerging market.
- More than 80 percent of New Zealand telecommunications companies regularly innovate, putting New Zealand at the top of the OECD rankings for company-level innovation.

However, unlike other developed countries which have a large population, it is very difficult to recover the cost of a significant infrastructure investment due to the limited demand in New Zealand. The Telecom industry has been relatively insulated from the full impact of the recession. In the year ending September 2009 (the worst of the economic crisis) NZ telecommunication revenues dropped 4% to \$5.4 billion from marginal 1% growth during the previous year (IDC 2010). While significant, it is not as severe as the decline in other sectors. IDC (2010).

The following market statistics (Table 2.1) from the Telecoms Industry report shows the industry growth and the projected forecasts until 2012.

Table 2.1: New Zealand Telecom Market Data

	2005	2006	2007	2008	2009	2010	2011	2012
Telephone main lines ('000)	1,830	1,758	1,754	1,697	1,629	1,551	1,483	1,414
Mobile Subscriptions ('000)	3,832	4,071	4,424	4,726	4,931	5,250	5,510	5,768
Internet users ('000)	2,578	2,786	2,925	3,047	3,116	3,264	3,453	3,703
Broadband subscriptions ('000)	321	470	853	915	1,030	1,195	1,373	1,576
No. of PC's (per 100 people)	50.9	55.3	60.2	64.6	66.8	68.6	70.1	71.7
IT services spend (US\$ m)	1,593	1,684	1,787	1,916	1,938	2,007	2,044	2,110
Total IT spend (US\$ m)	3,335	3,865	4,032	4,345	4,160	4,491	4,652	4,890

Source: The Economist Intelligence Unit Ltd (2010)

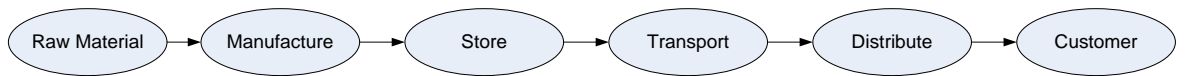
In view of the growing market, even to sustain current performance, organisations must find ways of increasing revenues and/or reducing costs.

2.4 The Telecommunication Supply Chain

2.4.1 Why is a telecom supply chain different?

Figure 2.1 is a schematic representation of a traditional manufacturing supply chain with the following elements (Asokan 2008). It is from the organisation's point of view. It must be noted that this is a simplified representation and variations exist in organisations. The key point to note is that it comprises of the following processes

- Raw materials are procured from one or more suppliers.
- The finished good is manufactured
- The product is stored in a warehouse
- It is then transported to a DC (Distribution Centre)
- It is then distributed to the customer

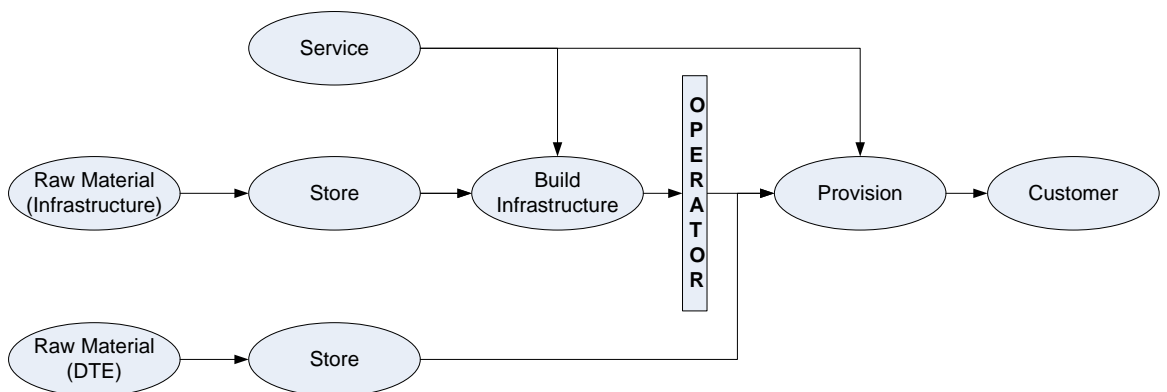
Figure 2.1: A traditional supply chain

Source: Adapted from Asokan (2008)

A Telecommunication supply chain is different (Figure 2.2). The processes occur in two stages and use a combination of services and raw materials, one to build the network infrastructure and the other to deploy the finished product to the customer. The key processes are as follows:

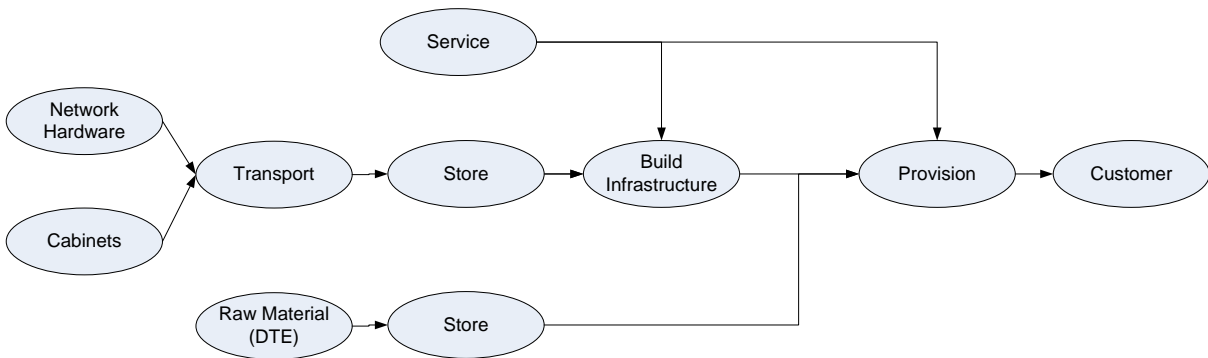
- Raw materials are procured from one or more suppliers for two purposes. To build the network infrastructure and to provision a service at the customer (Examples are mobile phones, modems)
- These are stored until it is used.
- There is no manufacture. Instead the network infrastructure has to be built, the inputs being raw materials and services.
- On receipt of a customer order, “provisioning” takes place and services and customer equipment (Data Terminating Equipment or DTE) are deployed.

Thus it can be seen that a combination of raw materials and services must be planned and managed in a telecom supply chain.

Figure 2.2: A telecom supply chain

Source: Adapted from Asokan (2008)

Figure 2.3: Telecom NZ Supply Chain Schematic

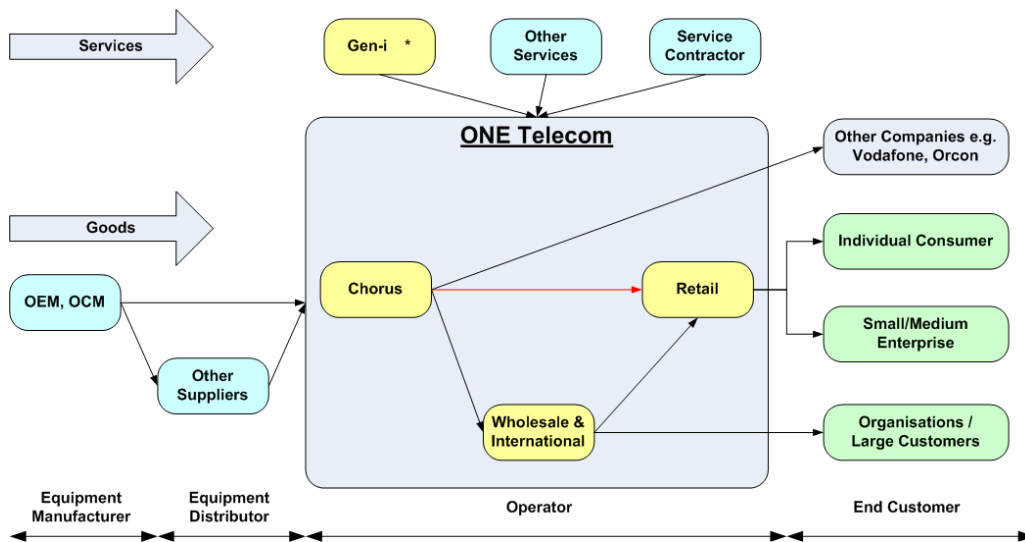


Source: Author

Figure 2.3 depicts the supply chain in Telecom New Zealand.

At a more detailed level, the extended supply chain at Telecom NZ can be represented as shown in Figure 2.4.

Figure 2.4: Telecom NZ Supply Chain model



Source: Author

In this context, it involves a number of different parties ranging from EMS (Electronic Manufacturing Services) like Flextronics, Solectron OEM or OCM

(Original Equipment/Contract Manufacturers) like Ericsson, Alcatel-Lucent, Juniper, Distributors, and Operators like Vodafone, Chorus, and Telecom Wholesale/Retail to the ultimate end customer like individuals or corporations. Also, it sells not just physical products like phones, PABX, modems etc. to the end customer but also various services like Mobile Services, broadband, PSTN, WAP, 3G.

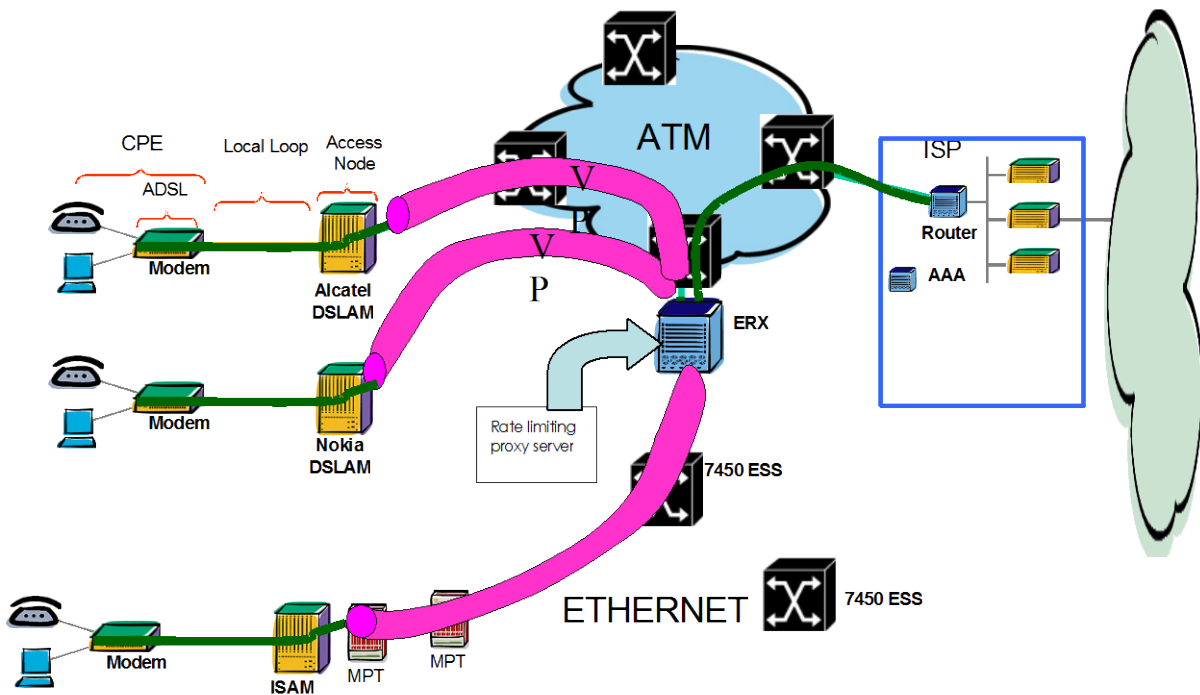
2.4.2 Fixed Networks

Land-line or fixed-line telecom networks are over 125 years old. Until the last decade, they were nothing but a telephone line that travelled through copper or fibre-optic cable as part of a nationwide telephone network. The same copper infrastructure has now been put to more use by the fixed-line telecommunication companies. It now provides broadband data and managed networking services to large organisations as well as wholesale network capacity over the same fixed cables. (Anon 2010a)

The forecast for fixed-line telecommunication is bright because the major players that provide the backbone network still provide the fastest data speeds. There is a growth in data service revenues as seen from Table 2.1. The market is now in the throes of triple play-broadband Internet, voice, and video over an IP network-to consumers.

Figure 2.5 below depicts an example of a fixed network used by Telecom for broadband. The complexity of the architecture and the number of components can be seen.

Components supplied by different manufacturers must work together in the network to provide the broadband service. There are various aggregation points in the network which carry the data and voice signal from a source to a destination through hundreds of kilometres of fibre or copper cable.

Figure 2.5: Example of a Fixed Network

Source: Telecom (2007)

2.5 Supply Chains in New Zealand

Basnet, Corner, Tan and Wisner (2003) found that a large proportion of New Zealand firms practice some form of SCM (about 90%). However these are mainly with a view to improving on-time delivery. Their survey listed the top three SCM activities as:

- On-time delivery of own firm's products directly to the customers' points of use
- On-time delivery of own purchased materials directly to the firm's points of use
- Determining customers' future needs

In the same survey, they cited the top three issues that hinder SCM as:

- Suppliers' geographical distance
- Lack of sophisticated information systems

- Lack of ability in managing inventories throughout the entire supply chain

They further conclude that New Zealand's geographical distance from world markets poses a significant challenge to SCM activities. In addition, the small size of New Zealand firms often makes it very difficult to pull all the supply chain members into the implementation.

Australian and New Zealand firms generally tend to work on internal logistics and supply chain processes. They generally lack externally oriented capabilities (Mollenkopf and Dapiran 2005).

In a subsequent research, Basnet et al (2008) conclude that NZ organisations have made a significant leap from having a cost focus to being a quality and customer based strategies. There has been a significant increase in the awareness of lean manufacturing, supplier integration and quality improvement strategies. However the adoption of these strategies has not gained momentum. Their research also showed that there is little awareness and adoption of advanced design and development strategies and of environmentally sustainable practices.

Research in Australia and New Zealand for purchasing or supply chains in the telecommunications industry was very difficult to locate.

2.6 Summary

IDC predicts that the telecommunications industry will recover, but it will be a modest recovery. There is an increasing pressure to transform with a hard squeeze on revenues and margins. The government's Ultra-Fast Broadband (UFB) initiative will kick off and this will lead to significant restructurings among the key players (IDC 2010).

From a company perspective, Telecom NZ has reported lower revenues and a lower operating profit. Whilst the company has a significant market presence and the broadband market is growing much faster, the company is faced with a number of

issues in the form of intense competition, network problems and the regulatory environment.

Also as shown in Table 2.1, the network market (broadband and mobile) is growing rapidly. With the increased growth and reduced margins, there is an increasing need for efficiencies in the supply chain in order to remain profitable.

In summary, the lessons to be learned from the past few years are that uncertainty rules the current world. The winners in this chaotic environment are those with an effective supply chain. Not only does it help deal with emergencies but it can dramatically improve customer responsiveness and profits. (Cook and Hagey 2010).

Thus organisations need to focus their efforts on optimising their supply chains and procurement is an important place to start.

Chapter 3. Literature Review

3.1 Introduction

This chapter presents the literature review for the research area. Finally a frame of reference in which the literature is to be used is conceptualized.

Supply Chain Management is a vast area and there are a number of topics that could be researched, ranging from strategic through tactical to the operational level. Simchi-Levi et al (2008) describe the following key issues in supply chain management that play an important role in designing and managing a supply chain.

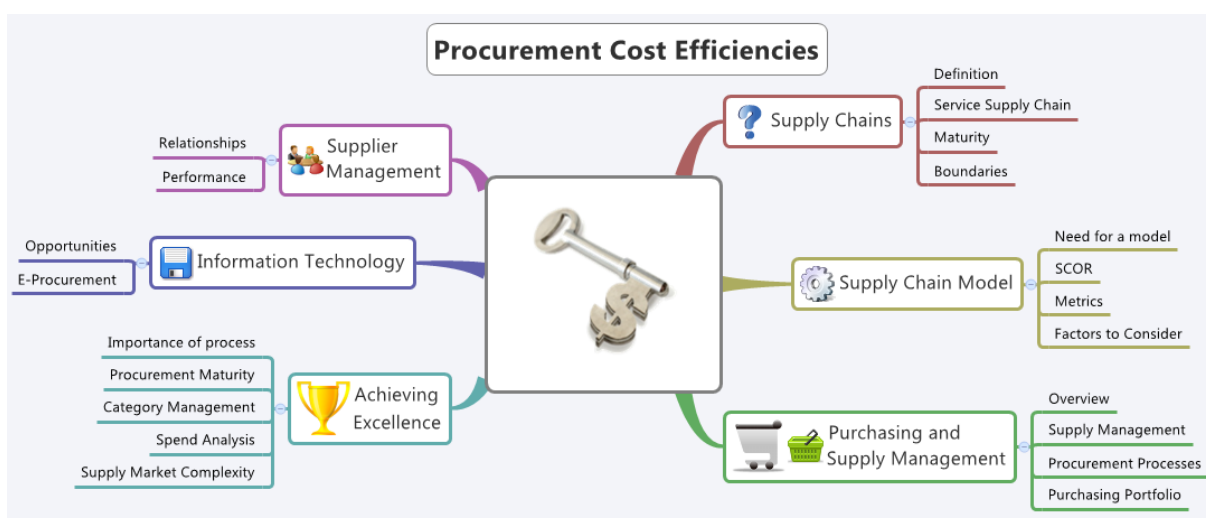
- Distribution Network Configuration
- Inventory Control
- Production Sourcing
- Supply Contracts
- Distribution Strategies
- Supply Chain Integration and Strategic Partnering
- Outsourcing and Offshoring Strategies
- Product Design
- Information Technology and Decision Support Systems
- Customer Value
- Smart Pricing
- Local Issues

The scope of this research is on procurement and supply management and only relevant topics have been covered. This literature review covers the following topics and is structured as follows. It is also depicted in Figure 3.1.

- Section 3.2 introduces supply chains and commences with some popular definitions. It is followed by a discussion on a services supply chain, boundaries of a supply chain and the importance of assessing the maturity of a supply chain.

- Section 3.3 explains the advantages of modelling a supply chain model in order to assess opportunities for improvements. The SCOR model published by the Supply Chain Council is proposed followed by the methodology for using it. Supply chain performance metrics are then discussed.
- Section 3.4 introduces Purchasing and Supply Management starting with the definitions and its importance in the supply chain. A description of procurement processes and the typical procurement cycle ensues followed by a discussion on segmenting the supply base using a portfolio approach.
- Section 3.5 is about Procurement Excellence. The discussion addresses steps to achieve excellence in procurement and includes topics such as assessing the maturity of procurement processes, category management and the need for spend analysis.
- Section 3.6 discusses the relevance of Information Technology in supply chains and leveraging it to achieve organisation goals and performance.
- Section 3.7 is about aspects of Supplier Management that are relevant to achieving efficiencies in purchasing and supply management. Topics discussed are supplier relationships and performance.

Figure 3.1: Literature Review – Topics Covered



Source: Author

3.2 Supply Chain Management

3.2.1 SCM definitions

The supply chain is now an internationally used term and encompasses activities involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer. Gibson et al (2005) say that since the term SCM first appeared, there have been numerous definitions of a supply chain. A few are mentioned below.

Harland (1996, Page 1) describes supply chain management as “managing business activities and relationships (1) internally within an organization, (2) with immediate suppliers, (3) with first and second-tier suppliers and customers along the supply chain, and (4) with the entire supply chain”.

Lambert & Cooper (2000, Page 1) state the definition of SCM as developed and used by GSCF as follows. They say “Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders”.

Mentzer et al (2001, Page 4) say “A supply chain is defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer”.

Handfield and Nichols (2002, Page 8) define the supply chain as “encompasses all organizations and activities associated with the flow and transformation of goods from the raw materials stage, through to the end user, as well as the associated information flows. Material and information flows both up and down the supply chain”. They define “Supply chain management (SCM) is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and high levels of information sharing to create high-performing value systems that provide member organizations a sustainable competitive advantage”.

Christopher (2005, Page 5) defines the Supply chain as “The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole”.

Ballou (2007) says that a supply chain refers to all those activities associated with the transformation and flow of goods and services, including their attendant information flows, from the sources of raw materials to end users.

Simchi-Levi et al (2008, Page 1) define Supply Chain Management as “a set of approaches utilized to efficiently integrate suppliers, manufactures, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements”.

The Council of Supply Chain Management Professionals (CSCMP 2010) has defined supply chain management as:

“Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies”.

Logistics is also very frequently used in conjunction with supply chains. The Council of Supply Chain Management Professionals (CSCMP 2010) defines it as

“Logistics is that part of the Supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customer’s requirements”.

Ballou (2007) further goes on to differentiate between logistics and SCM. He views SCM as managing product flows across multiple enterprises and logistics as managing the product flow activities just within the firm. He concludes that logistics is now a subset of SCM and is primarily concerned with activity administration.

Inter-functional and inter-organizational management are now within the purview of SCM rather than logistics. Furthermore purchasing and production are now included within the scope of SCM. As a result, SCM is responsible for 70-80 percent of the cost of sales for many firms

Stock and Boyer (2009) researched the various definitions of SCM with purpose of arriving at a consensus. They argue that there is no uniform agreed definition of SCM and an integrated definition will greatly improve researchers in the field. They have proposed a consensus definition of SCM as “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction”

In summary, the role of SCM must cover both the strategic elements and the key activities within an organisation. Supplier and customer collaboration is seen as a key component of SCM. (Gibson et al)

3.2.2 Service Supply Chains

Historically supply chain management has been focussed on manufactured goods (Ellram 2004). However services are becoming exceedingly important and the service sector growth has been phenomenal. Outsourcing of services has seen a tremendous growth. Van Weele (2005) states that in developed countries, services account for over 65% of employment.

A Service Supply Chain is analogous to Supply Chain (Voudoris et al 2008) but for services. Service Chain Management is about the planning and management of activities from support functions to the delivery of end-user services. The flow of materials may vary wildly from being almost negligible in some situations to a

considerable amount. Thus techniques developed for SCM may need to be refined. According to Ellram (2004), most supply chain models focus on the flow of goods and this is the obvious link that is missing in the services supply chain. Voudoris et al (2008) further go on to say that the most important characteristic is the lack of physical transformation of the product and the absence of a clear, well-defined relationship between input, throughput and output. They also say that whilst the spend may be lower, there is tremendous variety in the services being purchased.

Ellram (2004, Page 17) further states that the services spend has not been managed well and purchasing control has been very limited. Thus she modifies the definition of a supply chain for professional services as follows

“Supply chain management is the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer.”

According to Van Weele (2010) the most important characteristic is the absence of a physical transformation i.e. manufacturing. In addition, he says that a clear and well-defined relationship between input, throughput and output does not exist.

Just like manufacturing companies, service companies must also plan and schedule resources to gain efficiencies and offer better customer service. Therefore techniques similar to MRP, ERP and planning must be used with the key difference being the resources are people and not goods. Thus concepts like inventory, supply or safety stock must be replaced with staffing levels and staffing costs represent OPEX. But the analogy stops here. Voudoris et al (2008) argue that service companies do not have the luxury of using concepts like centralizing manufacturing or relocating the warehouse to reduce costs as people must be co-located near the customers. However there are other concepts like off-shoring and centralising systems that can achieve the same result. It must also be noted that service level agreements (SLA) and statements of work (SOW) are not as precise as manufacturing specifications for goods and service performance is not as easy to measure as product quality.

3.2.3 Supply Chain Boundaries

Supply chain management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance, and information technology (CSCMP 2010).

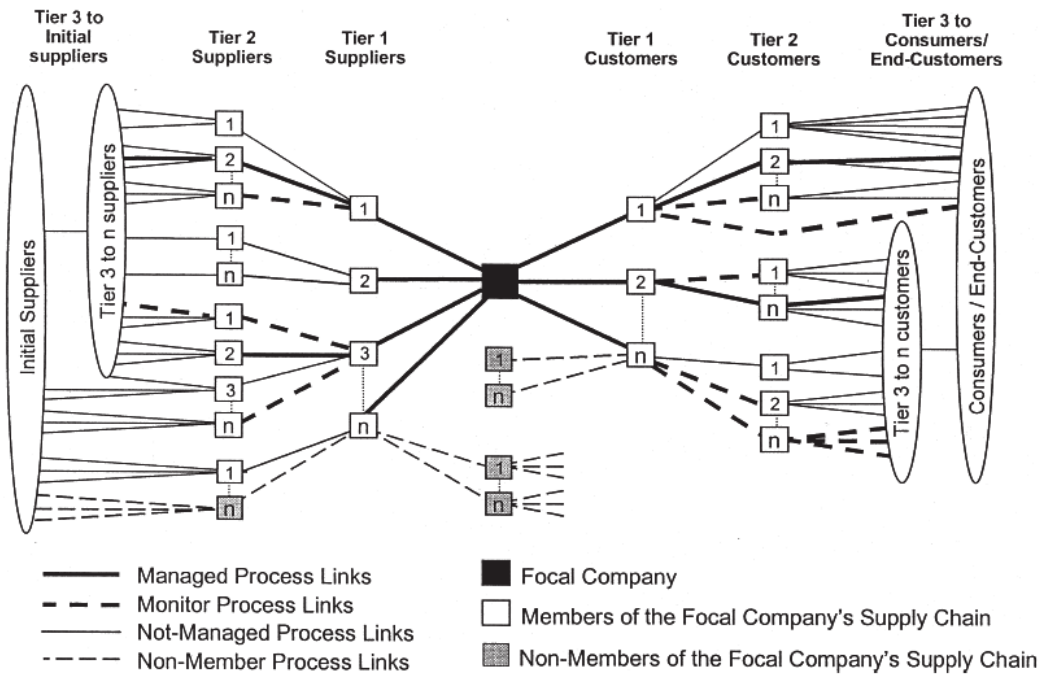
Due to its wide scope, supply chain management addresses complex interdependencies; in effect creating an "extended enterprise" that reaches far beyond the factory door. Today, material and service suppliers, channel supply partners (e.g. wholesalers, distributors or retailers), and customers are all key players in supply-chain management.

According to certain definitions of supply chains, there has to be more than one company involved in the chain in order for it to be defined as a Supply chain. Holmberg (2000) claims that at least three organisations working cooperatively with some shared objectives are required to form a Supply Chain.

Shapiro (2001) says that a supply chain comprises of geographically dispersed facilities where raw material, intermediate products or finished products are acquired, transformed, stored or sold and transportation links that connect facilities along with products flow. The facilities can be operated by the own company or by vendors, customers, third party providers or with other companies with which the company has business arrangements.

This is best illustrated by the network structure depicted in Figure 3.2.

Figure 3.2: Inter-company links



Source: Lambert & Cooper (2000)

There are a number of aspects of a supply chain that are relevant. The key one is the reach and the scope of the processes, and has the potential of making a supply chain complex. Mentzer et al (2001) identify three degrees of supply chain complexity, viz.

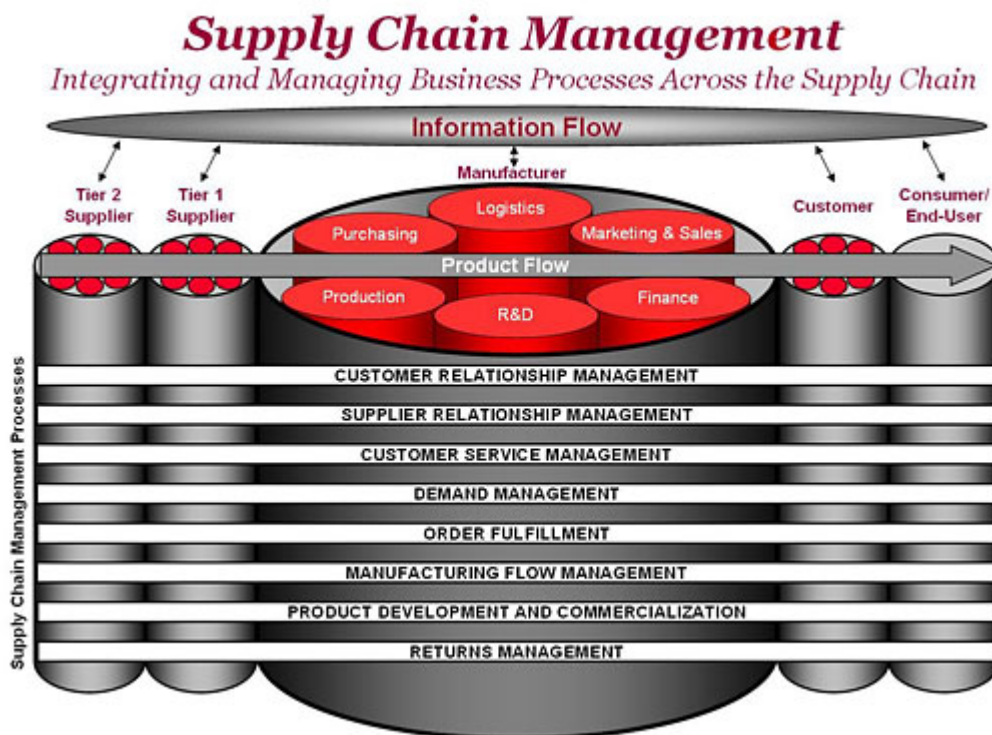
- A direct supply chain – consisting of a company, its suppliers and customers
- An extended supply chain also includes the supplier’s supplier and the customer’s customer
- An ultimate supply chain includes all organizations involved in the upstream and downstream flow of products, services, information and finances. This is also referred to as a value chain in some instances.

Lambert and Cooper (2000) illustrate this concept by depicting a supply chain network structure; the corresponding product and information flows; and the key business processes as shown in Figure 3.3. It is worth noting that these business

processes go across functions within the company and various other organisations across the supply chain.

Their research concludes that the structure of activities within and between companies is critical for superior supply chain performance. A successful SCM is about integration and standardisation of business processes with its key members. Lack of integration leads to wastage of valuable resources. Standard business processes result in a common language across the supply chain and easy link-up between the members.

Figure 3.3: SCM Process



Source: Lambert and Cooper (2000)

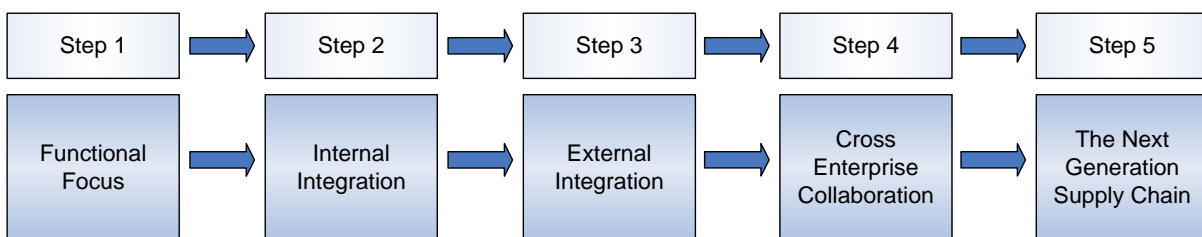
Ballou (2007) quotes a research survey performed by Fawcett & Magnon (2002) to study the extent of integration between the members of a supply chain. They found that about one-half of the firms are working toward integration within the walls of

their own firms. Whether this interfunctional integration is attributed to the implementation of large software systems such as SAP rather than to actual collaboration and compromise is not clear. Approximately one third of the firms focus their integration efforts on their first-tier suppliers. Beyond that, there is little attempt at integration. This is probably due to the inherent difficulties of achieving effective collaboration and to the limitations brought about by competition, such as the reluctance to share proprietary information.

3.2.4 Supply Chain Maturity

Following on from the complexity, Lockamy and McCormack (2004a) define a process maturity model of a supply chain as shown in Figure 3.4.

Figure 3.4: Supply Chain Maturity



Source: Adapted from (Lockamy and McCormack, 2004a)

The five stages of supply chain maturity that have been identified are:

1. Adhoc or Functional Focus. The supply chain is unstructured and there is minimal co-ordination between various departments or functions. SCM costs are high and customer satisfaction is low
2. Internal Integration. In this stage basic SCM processes are defined and documented, but the activities and organisation remain traditional. SCM costs remain high; customer satisfaction has improved, but is still low.

3. External Integration. This stage represents a step improvement. Co-operation between departments, vendors and customers is established. SCM costs start reducing and customer satisfaction begins to rise.
4. Cross-Enterprise Collaboration. The company, its customers and suppliers co-operate on the process level. SCM performance measures and management systems like APS are in place. Advanced SCM practices, like CPFR (collaborative planning forecasting and replenishment), VMI (Vendor Managed Inventory) with other members of a supply chain are in place. As a result, SCM costs are dramatically reduced and customer satisfaction is high.
5. The Next Generation Supply Chain. The competition is now based on supply chains. Collaboration between companies is on the highest level and a group of companies form SCM teams with common processes and objectives. At this stage the focus is not just on cost and customer satisfaction but on supply chain response and agility.

The Supply Chain maturity is important in assessing at what stage an organisation is. Most companies are somewhere between stages 1 and 2. There can be devastating financial impacts when companies experience supply chain disruptions. Research has shown that Supply Chain process performance is strongly related to Supply Chain maturity (McCormack, Ladeira, Oliveria 2008). In a maturity matrix, the above stages are cross-referenced against the Plan, Source, Make, Deliver and Return supply chain phases.

“Best in class” organizations have their supply chain strategies at the product, not corporate level since the requirements vary during the product life cycle and also differ by characteristics like forecast volatility or delivery requirements.

3.3 Modelling the supply chain

Before implementing any kind of supply chain initiative, it is always desirable to model the supply chain. The reasons for this are

- A supply chain model provides a map of the supply chain and allows one to clearly visualise and document the flow of information and materials.
- It allows comparison between other supply chains within and outside the organisation using a common set of definitions
- It allows for standardisation of supply chain processes in the organisation
- It makes the calculation of performance metrics easier

3.3.1 Why a supply chain model?

Many organisations have taken considerable measures to address problems and improve efficiencies in the supply chain. Chopra & Meindl (2007) address these issues in three levels.

1. Competitive strategy like outsourcing, location decisions, demand planning and forecasting, supplier selection, enablement of information systems, designing distribution channels.
2. Tactical planning like inventory control, order aggregation, synchronisation of production and distribution.
3. Operation routines like manufacturing labour and transport scheduling.

Depending on the need, an organisation can have many initiatives to address problems at different levels. However to be able to assess them, a clear view of the current state (As-Is) and the future state (To-Be) after implementation of the initiatives is required. Therefore, the requirement of a good supply chain model is to describe the characteristics such as the relationship between partners, all business processes and information flow (Xia 2006).

There are a number of ways to map and measure the performance of a supply chain. The Supply Chain Operating Reference (SCOR) model established by the Supply Chain Council is one such way and has found wide acceptance as evidenced by the number of books and papers that reference it. This model is a process reference model that integrates the best practices for supply-chain operations business process reengineering. It has gained much popularity and is now commonly used in a number

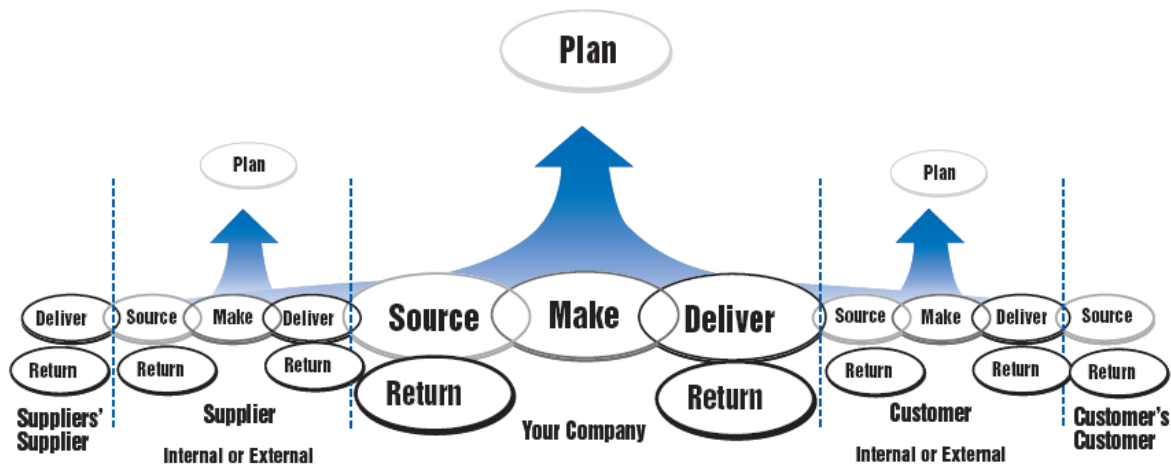
of organisations (Xia 2006). The model has been able to successfully describe and provide a basis for supply chain improvement for global projects as well as site-specific projects.

3.3.2 The SCOR model

The Supply Chain Council has developed a more widely accepted set of performance measurements over the last few years. Simchi-Levi et al (2008) describe that this work was launched in 1996 by AMR and Pittiglio Rabin Todd and McGrath (PRTM) in 1996. Their idea was to develop a reference model that gained industry-wide acceptance. Since then, over 1000 companies have joined the Supply Chain Council and contribute to the development of the model, which is now at version 10 (Simchi-Levi et al 2008). In New Zealand, companies such as Douglas Pharmaceuticals, Fonterra, Ballance are some members of the Supply Chain Council. SCOR combines a process framework with performance measures as well as best practices and benchmarking, spanning from the supplier's supplier to the customer's customer (SCC 2010a).

The SCOR-model has been developed to describe the business activities associated with all phases of a supply chain. By using process building blocks, the model can be used to describe supply chains that are very simple or very complex using a common set of definitions. As a result, it can be applied to virtually any industry.

Huang, Sheoran and Wang (2004) say that SCOR is a strategic planning tool that allows senior managers to visualise and simplify their supply chain. They suggest that SCOR is firmly mooted in current industrial practices and is poised to become an industry standard.

Figure 3.5: The SCOR Model

Source: SCC (2010a)

SCOR addresses five distinct business domains called management processes i.e. Plan (P), Source (S), Make (M), Deliver (D) and Return (R) as shown in Figure 3.5. (SCC 2010)

- The Plan process balances the demand and supply to best meet the sourcing, manufacturing and delivery requirements.
- The Source process procures goods and services to meet planned or actual demand.
- The Make process transforms product to a finished state to meet planned or actual demand.
- The Deliver process provides finished goods to meet planned or actual demand, typically including order management, transportation management and distribution management.
- The Return process is associated with returning or receiving returned products for any reason.

In addition, the model defines four levels of decomposition but only addresses the first three levels in the standard. The fourth and lower levels are the business differentiator of a company. The three levels are:

1. Level 1 or Process Type is the top level provides a balanced domain and cross process categorization. It defines scope of a supply chain.
2. Level 2 or Process Category is the configuration level provides a reconfigurable level that companies adjust to their own business plans
3. Level 3 or Process Element is the lowest level in the model and contains the process modules that operate within a business component and can be reconfigured to achieve the higher level processes
4. Below this level is the implementation of the supply chain practice within the company which contains the specific activities and tasks. It can be decomposed down to many levels depending on the organisations practices.

Bolstorff and Rosenbaum (2007) describe a process for defining the various supply chains in a company using the SCOR model. Each basic supply chain within an organisation is a “chain” of the above processes. In most cases, a supply chain is defined by a combination of product, customer and geography. It may also include financial information. They propose using a supply chain definition matrix to help identify the number of supply chains and the material flows. The next step is to select a balanced set of metrics from the list of available SCOR metrics. This is then used to report on the current state and as a guideline to measure after any proposed improvements.

When modelling a supply chain using SCOR, one or more of the following approaches can be used. (Bolstorff and Rosenbaum 2007)

- Business Scope diagram. This sets the scope for a project or organization
- Geographic Map. It describes material flows in a geographic context and highlights node complexities or redundancies.
- Thread Diagram. It depicts the flow of material in the supply chain at a high level (level 2 process) and also highlights process complexities or redundancies.
- Workflow or Process Models. This provides detailed information, material and work flow diagram at level 3 or beyond. It highlights information, people and system interaction issues

Each execution process (Source, Make and Deliver has three possible configurations which require different supply chain strategies (SCC 210a). They are

- Make-to-Stock represented by S1, M1 and D1. These products are typically inventory driven, have standard material orders, a high fill-rate and a short turnaround. Example is a product stocked in a supermarket shelf. It is taken off the shelf and replenished.
- Make-to-Order represented by S2, M2 and D2. These products are customer order driven, use configurable materials and have longer turn-around times. An example is a tailor making a shirt based on the customer's choice of materials and measurement or a car built with a combination of colour, seats and other features.
- Engineer-to-Order represented by S3, M3 and D3. These are customer requirements driven that require new materials to be sourced and has the longest lead times and low fill rates. An example is the making of a new kitchen. The architect custom builds it with some custom sourced materials.

A supply chain can have one or more of these configurations. The thread diagram depicts processes at this level.

3.3.3 Supply Chain Performance Metrics

A recent study found that while improving the supply chain performance is the key goal for most companies, less than 10% are adequately tracking their performance. Even fewer (7%) collect the necessary information to measure performance (Cook and Hagey 2003).

There are a few reasons for this dismal statistic. Most companies are hazy about their supply-chain performance and fail to recognise that the supply chain extends to their customers and suppliers. Moreover incentives and rewards are not tied to supply-chain improvements. There is a tendency to view Information Technology as a panacea. Cook and Hagey (2003) advise that organisations must get their supply chain strategy and design right and use proper metrics to measure performance.

Figure 3.6: SCOR Metrics

Level 1 Strategic Metrics	Performance Attributes				
	Customer-Facing			Internal-Facing	
	Reliability	Responsiveness	Agility	Costs	Assets
Perfect Order Fulfillment	✓				
Order Fulfillment Cycle Time		✓			
Upside Supply Chain Flexibility			✓		
Upside Supply Chain Adaptability			✓		
Downside Supply Chain Adaptability			✓		
Supply Chain Management Cost				✓	
Cost of Goods Sold				✓	
Cash-To-Cash Cycle Time					✓
Return on Supply Chain Fixed Assets					✓
Return on Working Capital					✓

Source: SCC (2010b)

In an attempt to have a standard set of performance measures, the Supply Chain Council (SCC 2010b) has published metrics in each area as shown in Figure 3.6. The council provides a detailed description of each metric and guidelines on calculating the values. Typically a company calculates specific metrics and compares it with the industry benchmark (Simchi-Levi et al 2008).

Gunasekaran et al. (2001) developed a framework for measuring performances of strategic, tactical and operational levels in supply chains. They recommend that performance measures in supply chains should strongly link to strategy and also have a balanced approach between the financial and non-financial aspects. In addition, they stress the importance of partnership evaluations in supply chains.

It can be concluded that there are two types of metrics, customer-facing and internal-facing. As the focus of this research is on procurement the internal-facing metrics are of more interest. Of these the most important for this research is the cash to cash cycle time or the C2C. This is a value metric used to measure how efficiently a company manages its working capital assets.

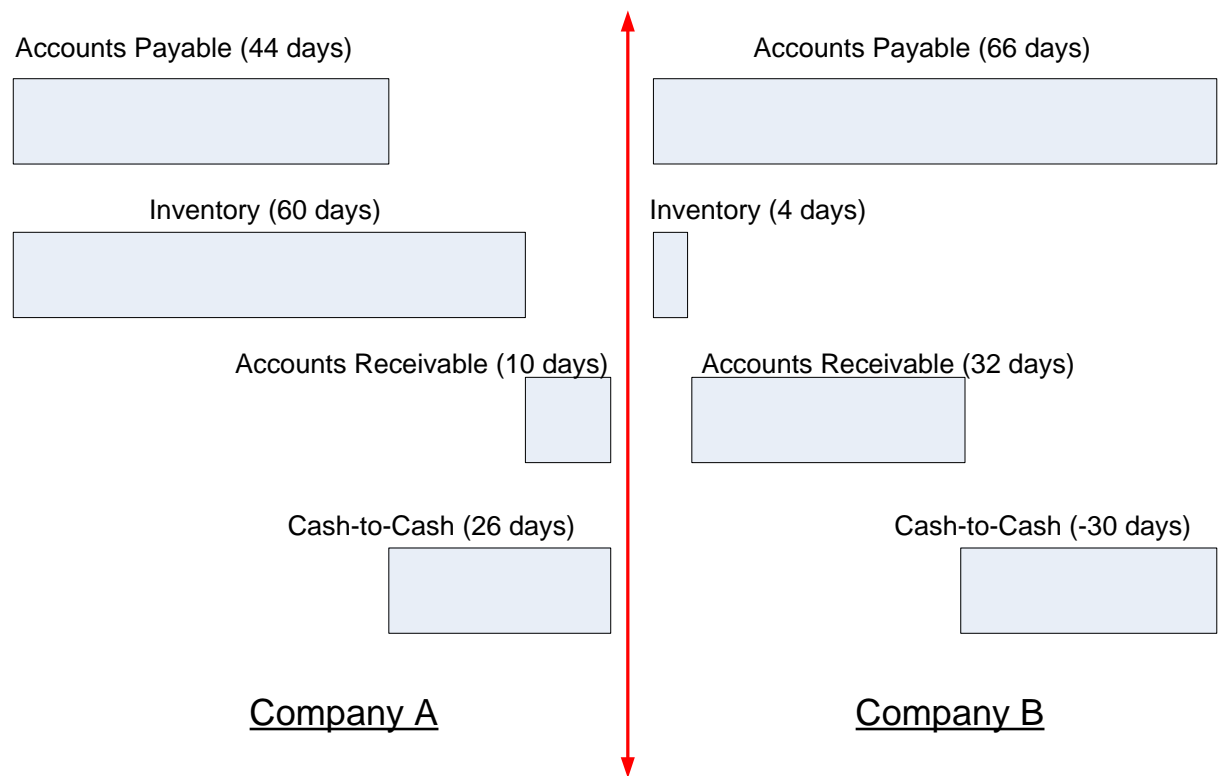
The Supply Chain Council defines the cash to cash cycle time as the time it takes for an investment made to flow back into a company after it has been spent for raw materials (SCC 2010b). Put simply, it is the time between when money is spent to money is received from sales, that is, the length of time for which inventory must be financed. For services, this represents the time from the point where a company pays for the resources consumed in the performance of a service to the time that the company received payment from the customer for those services.

The calculation for C2C is calculated using three drivers of working capital.

<p>Inventory days of supply (Time taken to convert raw materials to finished goods)</p> <p style="text-align: center;">+ PLUS</p> <p>Days sales outstanding (No. of days from product sale to receipt of cash from customer)</p> <p style="text-align: center;">– MINUS</p> <p>Days Payables outstanding (Time taken to pay suppliers for purchases)</p>
--

The longer the cash-to-cash cycle, the more current assets needed (relative to current liabilities) since it takes longer to convert inventories and receivables into cash. In other words, the longer the cash-to-cash cycle, the more net working capital required. Typically a “best-in-class” company have less than a 30 day cycle time whereas median performers can be up to 100 days (Simchi-Levi et al 2008).

Farris & Hutchinson (2003) propose that the simplest way to understand it is as “the days between accounts payable and accounts receivable”. In other words, it is the length of time between cash payment for purchases and cash received from the customer. Some organisations like Dell have a negative C2C which means that the customer pays for the goods before Dell pays it suppliers. This is illustrated in Figure 3.7 below.

Figure 3.7: Cash to Cash cycle time

Source: Adapted from Farris & Hutchinson (2003)

Farris & Hutchinson (2003) further elaborate on the importance of measuring C2C and provide three primary leverage points to manage this metric within an organisation.

1. Extend average accounts payable. One approach is to increase accounts payable associated with inventory and obtain interest-free financing. Suggestions include using electronic payments and pay at the last possible point, make partial payments to suppliers, use early payment discounts.
2. Reduce inventory days of supply. Implement optimum inventory balances by making use of JIT, good forecasting techniques, CPFR.
3. Reduce average accounts receivable. This can be done by expediting collections or electronic payments from customers.

The most beneficial would be to have collaboration between suppliers to ensure shorter lead-times.

ERP systems like SAP and Oracle also support SCOR metrics and offer “out of the box” reports to calculate them. From an SAP perspective (SAP 2010), the following are the key attributes of the “Source” process

- Definition: Processes that procure goods and services to meet planned or actual demand
- The key functions are
 - Material acquisition:
 - Obtain, receive inspect, hold, issue material
 - Manage sourcing infrastructure:
 - Manage vendor contracts, payments, certification and feedback
 - Control sourcing quality
 - Engineer components
- The metrics are
 - Vendor lead times
 - Materials quality
 - Materials inventories

3.3.4 Factors to Consider

Whilst there has been a wide acceptance of SCOR for supply chain modelling, a number of factors must be considered in order to use it effectively.

- SCOR does not cover all processes or activities. Examples include demand generation (sales & marketing), research & development and new product development. Other reference models were developed for it, viz. CCOR (Customer Chain Operating Reference) and DCOR (Design Chain Operating Reference). However these models have not been as widely accepted as SCOR.
- The use of SCOR in service supply chains has not yet gained popularity.

- A number of SCOR metrics are available as discussed in Section 3.3.3. Some of these are of prime importance when benchmarking, whilst others are to be used for routine management. The Supply Chain Council does not provide detailed explanations on calculating these metrics. The authors view based on her experience as a SCOR certified consultant is that the calculation of some metrics can be very subjective, and must be carefully used.
- Gulledge and Chavusholu (2007) say that achieving the full benefits from the SCOR model is only possible through effective business process management and the calculation of SCOR key performance indicators (KPIs). However calculation of these metrics must be performed regularly and this is possible only through automation of the data collection. In their paper, they have demonstrated the feasibility of the automation from popular ERP systems.
- Lockamy and McCormack (2004b) investigated the relationship between supply chain management best practices and supply chain performance based on SCOR's Plan, Source, Make and Deliver decision areas. They concluded that
 - Planning processes are important in all SCOR supply chain planning decision areas.
 - Supply Chain Collaboration was found to be most important in the Plan, Source and Make planning decision areas but not Deliver.
 - Teaming was most important in supporting the Plan and Source planning decision areas.
 - Process measures, process credibility, process integration, and information technology were found to be most critical in supporting the Deliver planning decision area.

3.3.5 A Revised SCOR model for Telecoms

As noted earlier, SCOR has a strong manufacturing focus since it was initially developed by manufacturing companies. It has been successfully used in manufacturing supply chains. However, there are very few instances of its usage in a

service oriented supply chain like the telecom industry. Thus all scenarios cannot be modelled using the standard SCOR processes.

Xia (2006) argues that the current SCOR framework is not enough to model supply chains in Telecom sector. The telecom industry is more than just telephone services. In addition to the transmission of voice and information it also covers activities like internet access.

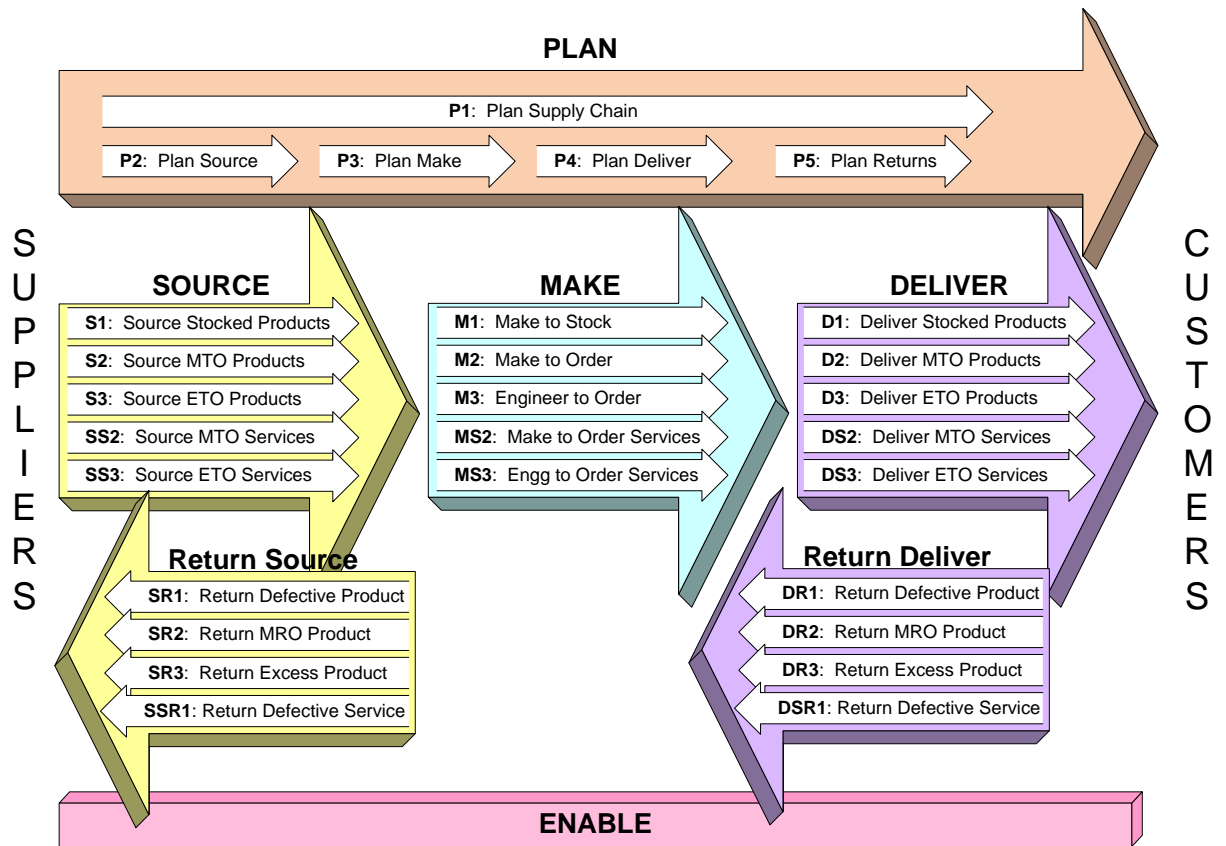
Not only do physical products flow through the supply chain, but also services. Thus it has elements of a goods as well as a service supply chain. At Telecom NZ, there is a goods supply chain for managing the key network equipment and at the same time a service supply chain to manage the installation of infrastructure equipment as well as the provisioning of services to end customers. There are different types of suppliers; some suppliers provide physical products; some provide pure services; and some provide both.

In order to address the model for this type of industry, Xia (2006) proposes addition of 8 new process categories for services as shown in Figure 3.8 below. With the enhanced toolkit, she believes it is easy to apply SCOR in wider industries, such as the Telecom industry.

The additions are

- SS2 - Source Make-to-order services
- SS3 - Source Engineer-to-order services
- MS2 - Make-to-order services
- MS3 - Engineer-to-order services
- DS2 - Deliver Make-to-order services
- DS3 - Deliver Engineer-to-order services
- DSR1 - Return defective services in Delivering
- SSR1 - Return defective services in Sourcing

Figure 3.8: Revised SCOR model



Source: Adapted from Xia (2006)

The Telecom NZ supply chain is not only concerned with flow of goods but also services and is characterised by a large customer base, fast-changing technology, high capital infrastructure and complex service offerings. Suppliers provide either goods or services or both. The focus of efficiencies is on management of capacity, resource flexibility, information flows, service performance and cash flow management.

3.4 Purchasing and Supply Management

3.4.1 Introduction

The main focus of this research is on purchasing and supply management. In simple terms, Purchasing can be described as acquisition of materials, facilities, services and equipment used in an organization. It is a basic function and is relevant to all types of business enterprises.

The terms purchasing, sourcing, procurement, and supply management are often used interchangeably (Leenders et al., 2002, p. 6).

The term purchasing can be defined as “the day-to-day management of material flows and information”. Identifying suppliers, buying, negotiating, contracting, and optimizing terms and conditions represent typical purchasing activities (Monczka et al., 2005).

Procurement is defined as “Securing supplies, materials and services of the right quality in the right quantity at the right time from the right place (source) at the right cost (Emmett and Crocker 2008, Page 1). They add that these five “rights” are inter-related and not mutually exclusive. This implies that procurement is even broader in scope. Procurement “includes specification development, value analysis, supplier market research, negotiation, buying activities, contract administration, inventory control, traffic, receiving, and stores” (ISM, 2006, page 25)

In contrast, the term supply management is strategic by nature. ISM (2010a, Page 1) defines it as “The identification, acquisition, access, positioning, management of resources and related capabilities the organization needs or potentially needs in the attainment of its strategic objectives.

3.4.2 Supply Management

Supply management is a cross-functional, proactive process for obtaining goods and services that features the active management and involvement of suppliers (Trent 2007). It involves

- Identifying total requirements for the supply chain network
- Developing supply strategies
- Evaluating and selecting suppliers
- Managing and developing suppliers to realise performance advantages
- Understanding what it costs

Field research from the Institute of Supply Management (ISM, 2010) describes the scope of supply management as “an integration” across fourteen components:

1. Disposition/Investment Recovery
2. Distribution
3. Inventory Control
4. Logistics
5. Manufacturing Supervision
6. Materials Management
7. Packaging
8. Procurement/Purchasing
9. Product/Service Development
10. Quality
11. Receiving
12. Strategic Sourcing
13. Transportation/Traffic/Shipping
14. Warehousing/Stores

A supply strategy typically refers to key decisions that must be made in constructing the “supply” side of a supply chain whilst keeping other aspects in perspective. It includes the purchasing organisation structure (centralised or decentralised), number

of suppliers, the type of relationship between the suppliers and the buyer, the length of contract.

A supply strategy is closely linked to the supply chain strategy and derives feedback from the procurement cycle. As can be seen below, a number of factors in the strategic sourcing and supply chain management areas have an influence on the procurement cycle.

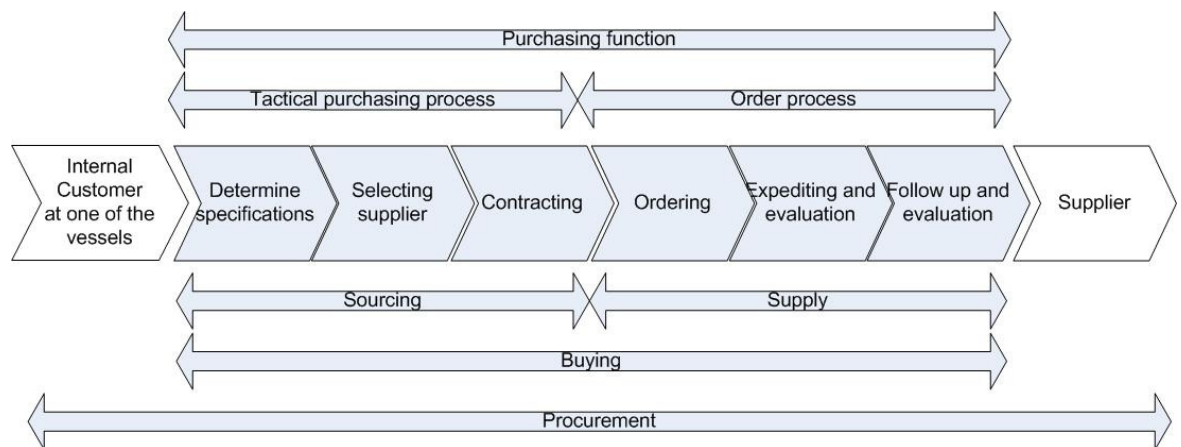
Because of the important impact of supply management on business results, the top supply management professional should be recognized as a key source of input and included in the overall business strategy development (ISM 2010).

3.4.3 Procurement Processes

The procurement process is typically divided into multiple steps. A well known purchasing process model is the one developed by Van Weele (2005). In this model, the purchasing process is divided into six steps

- Determining specifications
- Selecting suppliers
- Contracting
- Ordering
- Expediting/evaluation
- Follow-up/evaluation

Furthermore the purchasing function is divided into two distinct types of processes; a tactical process that deals with sourcing and an operational process that deals with the order execution as shown in Figure 3.9 below.

Figure 3.9: Purchasing Process Model

Source: Van Weele (2005)

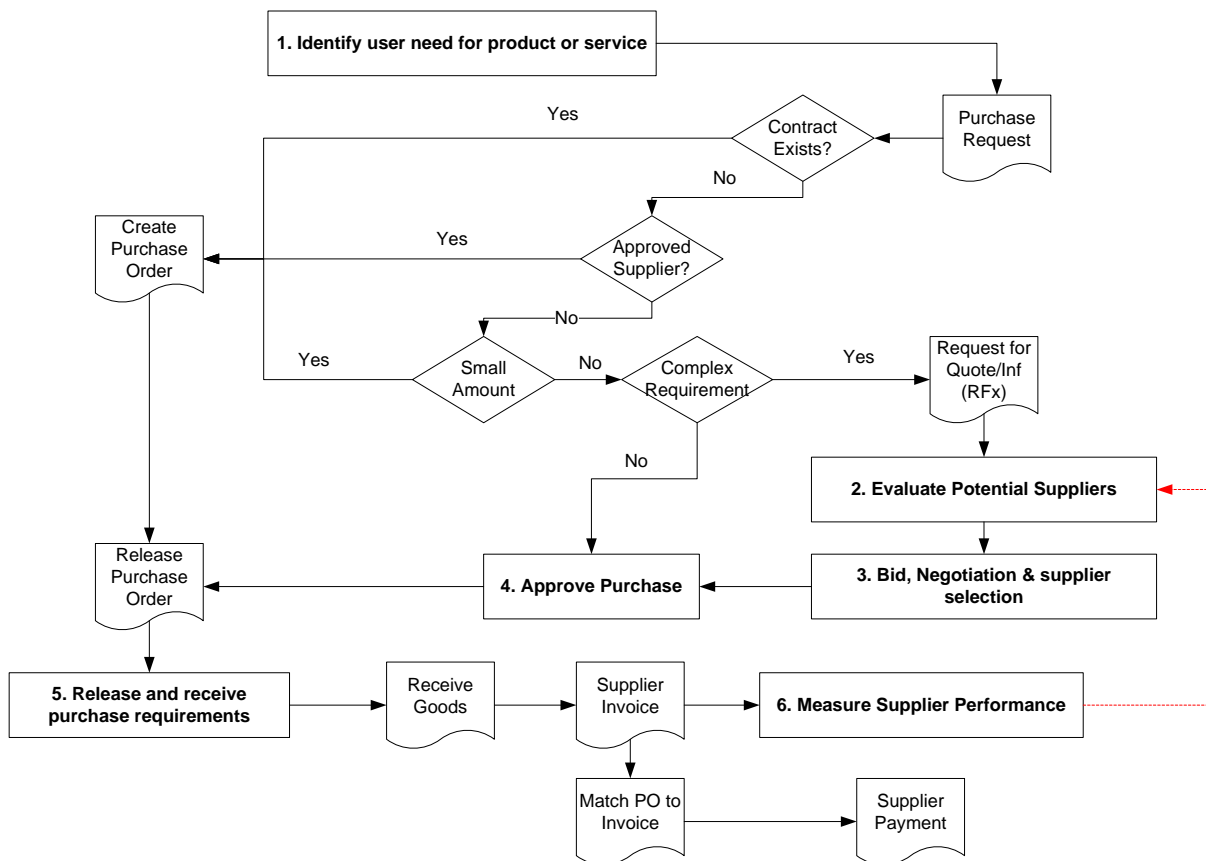
Van Weele (2005) further describes the four main dimensions of the purchasing function, namely

- A Technical Dimension that is mainly about the functionality, specification and quality of the goods or service to be purchased. The key activities here are the specification of goods and services to be purchased, auditing supplier's quality organisation, value analysis, quality Control, supplier selection and drawing up of the contract.
- A Commercial dimension, which is mainly about the relationship with the suppliers and contractual conditions to be negotiated. The key activities here are supply market research, supplier visits, request for quotations, evaluation of quotations and supplier negotiations.
- A Logistical dimension which is about activities required to optimise the flow of materials from the supplier until it is consumed. It pertains to activities like ordering policies, delivery reliability etc.
- An Administrative dimension which is about efficiency in order and invoice processing and deals with order handling, invoice verification and payments to suppliers.

Monczka, Trent and Handfield (2005) state that a typical purchase order cycle comprises of the following steps as described in Figure 3.10.

The starting point is the requirement of a product or service. This is very important as it dictates the rest of the processes like supplier evaluation, order placement etc. With this one can infer that the buyer must have sufficient technical knowledge, an understanding for the commercials, logistics and administration.

Figure 3.10: A Typical Purchase Order Cycle



Source: Adapted from Monczka, Trent and Handfield (2005)

Emmett and Crocker (2008) define the procurement cycle as comprising of three stages.

- The Pre-Order Stage. This is mainly about needs and requirements and the steps are need, specify, sourcing, enquiry, negotiation and selection.

- The Order Stage. This is primarily about ordering, progressing/expediting, delivery and receipt processing
- The Post-Order stage. The key steps here are invoice verification, payment and review.

The purchase order process depicted in Figure 3.10 is routinely used in all organisations. However due to the nature of the decisions the purchase processing can be costly and inaccurate Benton (2007). He further describes the principles of TCO (Total Cost of Ownership). In this instance, the total cost of procurement includes the following steps.

- Identify Need
- Requisition Item
- Shortlist potential suppliers
- Evaluate bids/quotes or RFx
- Issue purchase order
- Expedite Order
- Document receipt of material
- Receive supplier invoice
- Verify and process invoice
- Pay supplier

Each step of the process can be subject to manual handling, errors, decisions and costs quickly add up. It can be streamlined with systems based processes and information technology.

3.4.4 Purchasing Portfolio

The importance of purchasing has grown over the years and it is now seen as a strategic function that contributes to the bottom-line of an organisation. Empirical evidence also indicates that organisations can obtain competitive advantage by appropriate management of supplier relations (Gelderman & van Weele 2005). There

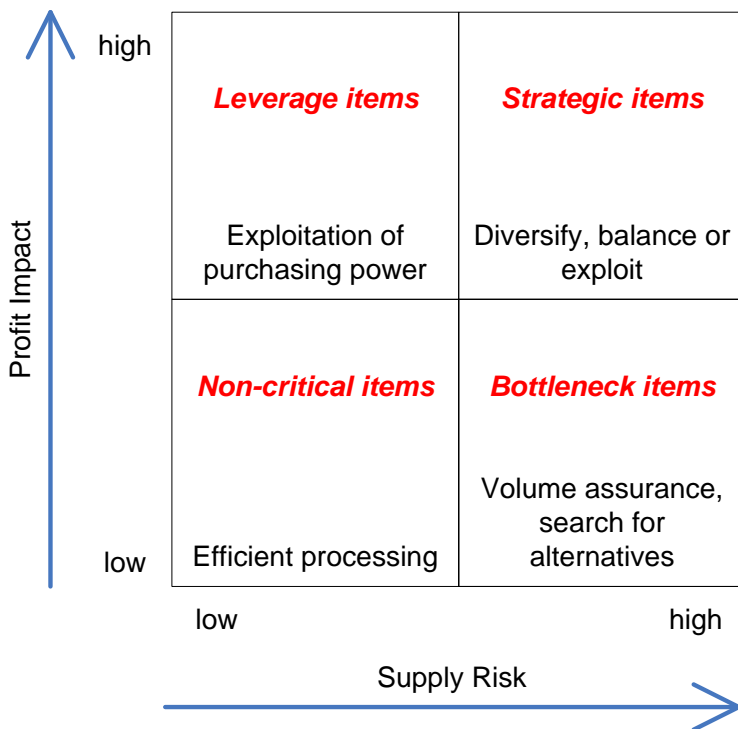
is an obvious need for differentiating suppliers since not all of them are equal. This need has resulted in the development of portfolio models and was first instigated by Kraljic (1983). His approach has lasted through the years in spite of some criticism and reviews (Gelderman & van Weele 2005). They also conclude that the position and professionalism of purchasing are both positively linked to the use of portfolio models and that its usage is definitely a sign of purchasing sophistication.

O’Brien (2009) also says that there have been many adaptations of and variants on Kraljic’s original work over the years and with different interpretations of both axis and quadrant labels and even a switching of the axis. But the underlying principles remain unchanged.

A company’s need for a supply strategy depends on two factors (Kraljic 1983).

1. The strategic importance of the product in terms of value and impact.
2. The complexity of the supply market based on scarcity, technological impact, monopoly or oligopoly conditions.

Figure 3.11: Purchasing Portfolio Model



Source: Gelderman & van Weele (2005)

By assessing these two variables, an organisation can determine the type of supply strategy required to exploit its purchasing power as well as reduce supply risk as shown in Figure 3.11.

Purchasing portfolio models like Kraljic's serve as an analytical tool to organise information and create a classification framework of the items included in the portfolio. In purchasing they could be used as a method of identifying which groups of products or suppliers require greater attention (Olsen & Ellram 1997).

With the help of the portfolio matrix, professional purchasers could optimize the use of capabilities of different suppliers (Nellore & Soderquist, 2000) and thereby effectively manage suppliers.

Cousins et al (2008) propose mapping sourcing structures to each quadrant of the Kraljic matrix. Sourcing structures provide a mechanism to implement the right supply strategy.

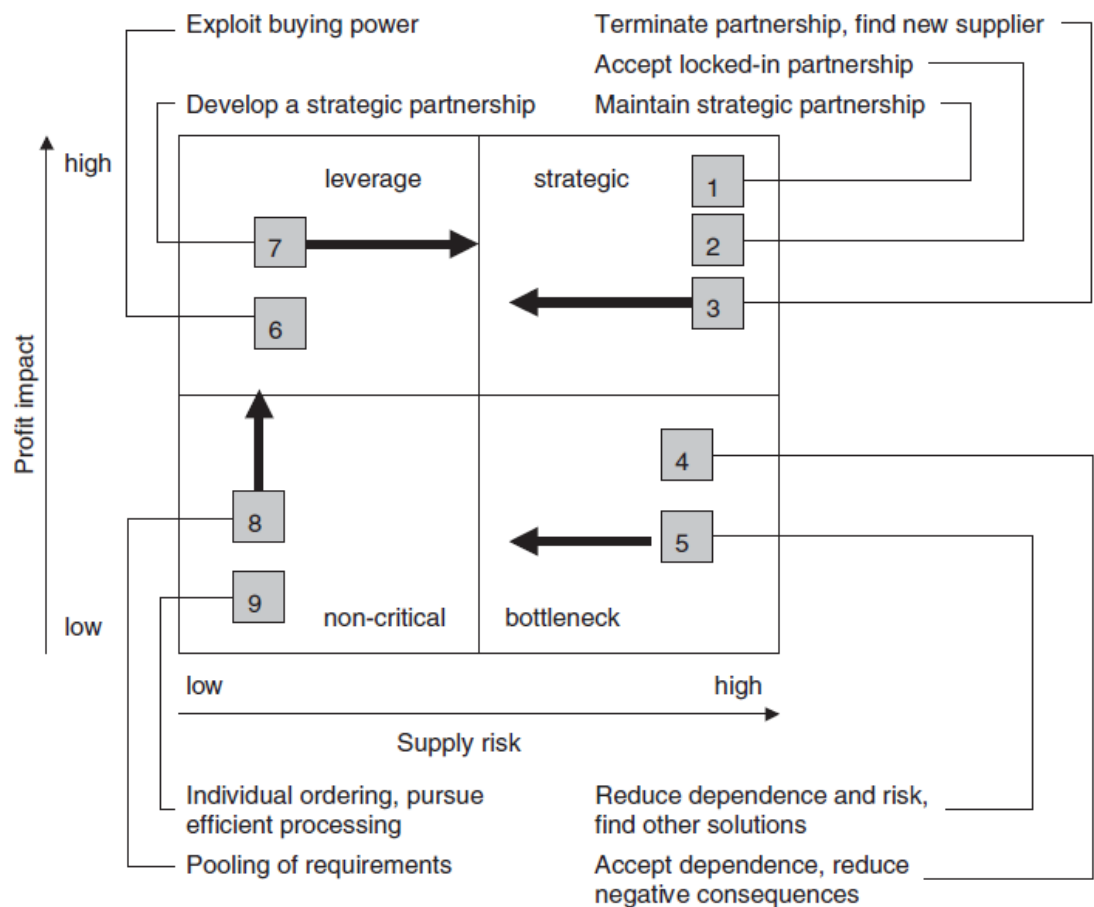
- Single sourcing: To be used for strategic or bottleneck items or where there is only one source of supply.
- Multiple sourcing. The buyer has a choice of suppliers to secure the "best deal" and used for the non-critical items
- Delegated sourcing. A multi-source approach where a supplier is responsible for managing other suppliers. It is very popular in 4PL scenarios and allows the buyer to focus on only one supplier leading to reduced management overheads. Ideal for use in the leverage quadrant.

Caniels and Gelderman (2005) analysed a number of research articles on purchasing portfolio models and concluded that most of them are based on Kraljic's original model. Thus Kraljic's model is very much the foundation for purchasing strategies. Experienced purchasing professionals typically come up with different purchasing strategies in each quadrant.

Each of the four quadrants described in Figure 3.11 requires a different approach to supplier management. The objective is to minimise supply risk and exploit

purchasing power and is depicted in Figure 3.12. The purchasing strategies for rationalisation is based on ensuring the right strategy for each quadrant and moving suppliers that do not match the strategy out of the quadrant (Caniels & Gelderman 2005)

1. Leverage items allow the buyer to exploit its full purchasing power by making extensive use of tendering, target pricing, negotiations etc. These items require a short-medium-term supply and demand forecast, accurate supplier data and price information for the analysis.
2. Non-critical items are routinely purchased and of low value. Hence it benefits from efficient transaction processing. Use of e-procurement strategies like EDI, eliminating waste in the procure-to-pay process to render it more efficient etc. would prove beneficial. These items require a short-term supply and demand forecast, management of economic order quantities (EOQ) and inventory levels.
3. Bottleneck items cause significant problems and risks and require techniques like volume insurance, safety stock and backup plans. Also searching for alternative suppliers may be required. These items require a medium-term supply and demand forecast, good market data and the focus should be on managing inventory costs and maintenance plans.
4. Strategic items require more collaboration between the buyer and supplier to minimise supply risk and exploit purchasing power. These items require highly detailed market data and a long term supply and demand forecast. A deeper understanding of costs using techniques like target costing or TCO analysis is recommended.

Figure 3.12: Overview of purchasing strategies

Source: Caniels & Gelderman (2005)

Not all suppliers have the same impact or require the same supply strategy even within each quadrant. Typically a few key suppliers account for the majority of the spend and they must be actively managed across all business units (Cavinato and Kauffman 2000).

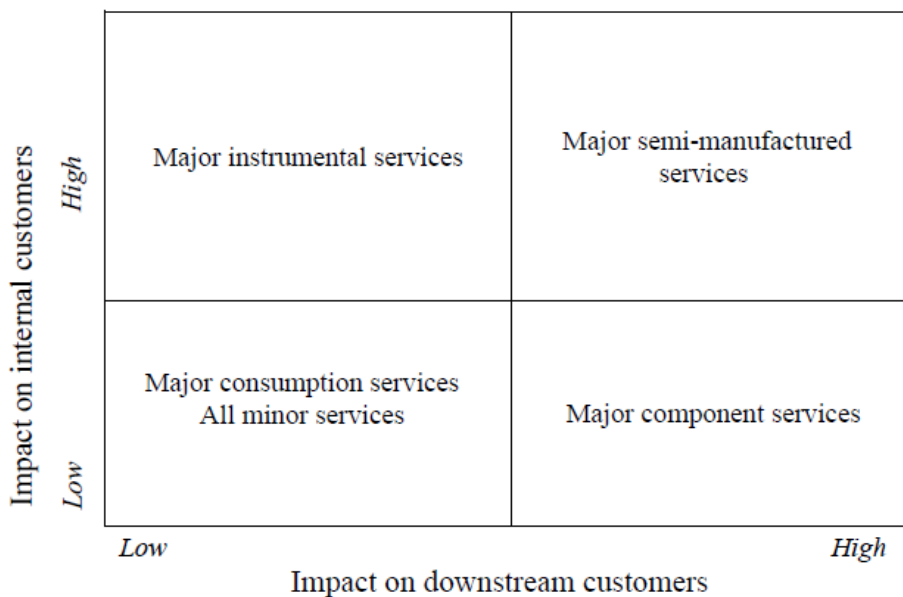
O'Brien (2009) recommends a three-step process in getting portfolio analysis to work.

- Initial Classification using Kraljic matrix
- Assess strength of position in the marketplace
- Determine the required strategic response.

3.4.5 A Portfolio for Services Procurement

Wynstra, Axelsson and Valk (2006) classify business services by application into four types, i.e. component, semi-manufacture, instrument or consumable. For each of these four types of services, the buying company should assess how they are applied. They use a similar portfolio approach to classify services based on the impact on internal customers as well as downstream customer as shown in Figure 3.13.

Figure 3.13: Classification of business services

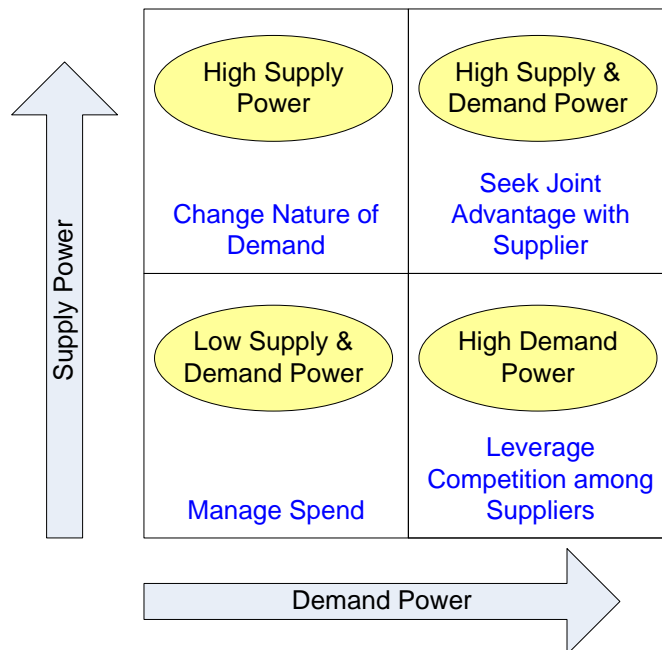


Source: Wynstra, Axelsson and Valk (2006)

3.4.6 Supply Market Complexity

Supply Management is faced with a complex market and a number of other external issues that pose a risk.

To help purchasers rise to the new challenges of a sellers market, Schuh et al (2009) describe use of the “Purchasing Chessboard”. It derives its basic concept from the relationship between supply and demand power as shown in Figure 3.14.

Figure 3.14: Supply and Demand Power

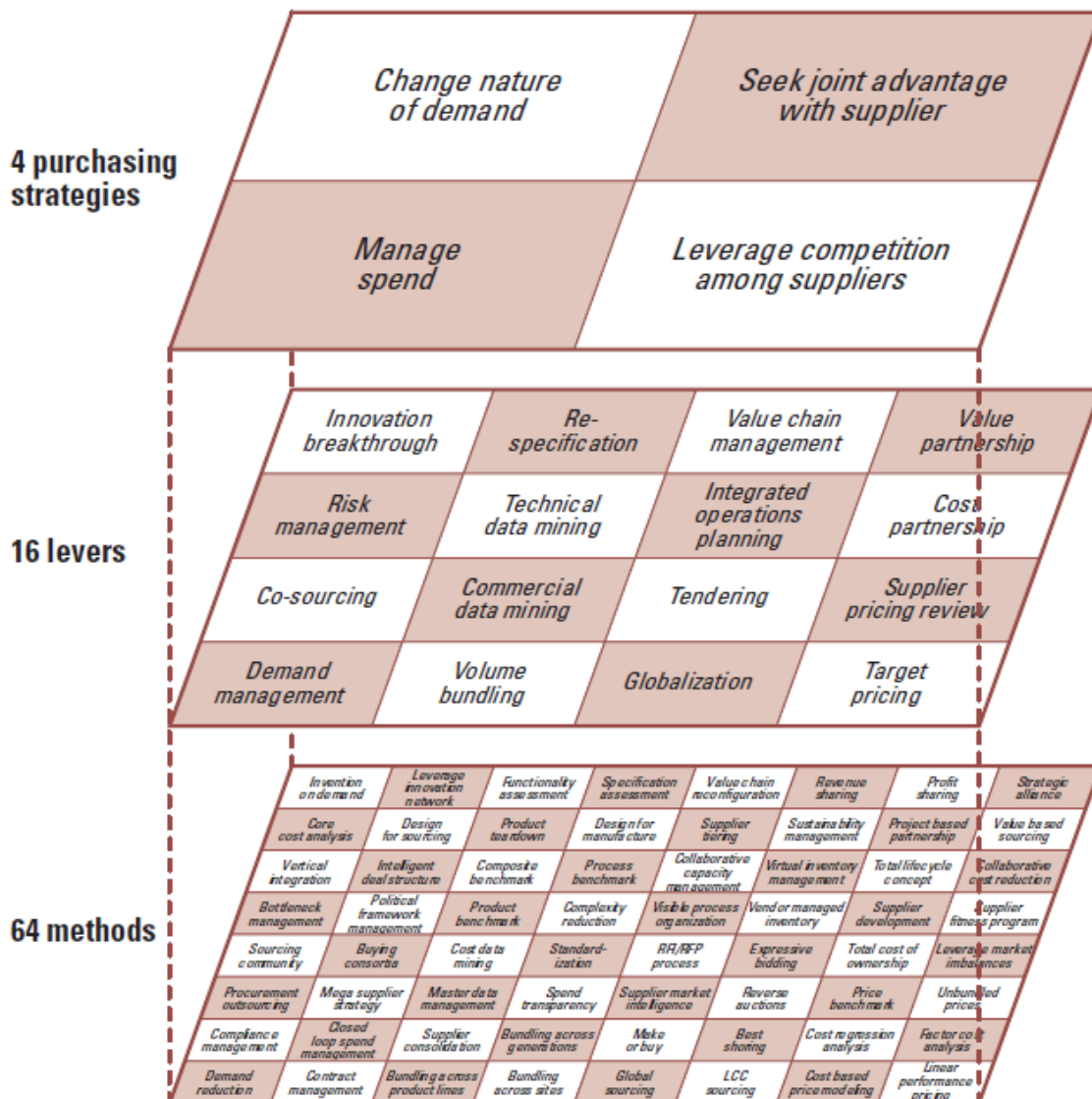
Source: Schuh et al (2009)

The Purchasing chessboard uses supply and demand power to categorise supply relations. It results in a portfolio that is easier to manage in today's environment.

To mitigate the risk, they should consider factors like power relations between buyers and suppliers, availability of supply and substitutes and competition within the industry (Cousins et al 2008).

This portfolio of supply and demand power is combined with 4 purchasing strategies and 16 approaches to form 64 methods of addressing spend. This is depicted in Figure 3.15.

Figure 3.15: The Purchasing Chessboard



Source: Schuh et al (2009)

The purchasing chessboard can be applied by placing specific categories on the chessboard depending on their specific demand and supply conditions. The relevant purchasing strategies can then be applied to these categories. This must be reviewed from time to time.

3.5 Achieving Procurement Excellence

3.5.1 Importance of good procurement practices

An analysis of costs in a typical organisation reveals that largest part of the costs of goods (COGS) sold are for purchased materials and services. This figure can be as high as 50%. Including other business costs that have a purchasing component can push this figure up to 68%. (Van Weele 2005)

Van Weele (2005) goes on to say that a saving of 2% on purchased materials and services can lead to a 9.2% improvement of return on capital employed (ROCE). The reverse is also true as a lack of a well defined process can lead to an unforeseen financial loss.

His observation is that highly successful companies with a mature purchasing organisation have well defined processes. Such processes are standardized, can be consistently executed, can deliver expected outcomes and are deeply embedded in daily workflows.

Emmett & Crocker (2008) describe a number of best practices in procurement to achieve excellence with a view to optimising costs and adding value.

Firstly based on their definition of procurement about “securing supplies, materials and services of the right quality in the right quantity at the right time from the right place (source) at the right cost”, they propose the following

- The “right quality” requires precise specifications to be agreed with the buyer. Best practices in this area are supplier quality reviews, use of correct material specifications, standardisation etc.
- The “right quantity” is important to manage inventory, transport, negotiate volume discounts and manage production. Best practices in this area are having a wider procurement / supply chain view of requirements that begins with establishing a demand plan all the way through use of techniques like JIT for inventory control, management of obsolescence, warehouse management and transport through to delivery.

- The “right time” to buy can be influenced by researching market conditions, supply lead-time, production schedules all of which require a good view of customer demand.
- The “right place” is about initial supplier selection and also ensuring delivery of goods or services to the correct location.
- The “right price” cannot be stressed enough. Best practices to ensure this are market research, spend analysis and TCO (Total Cost of Ownership) approach for capital items.

In order to achieve these, they recommend the following best practices:

- Spend Visibility
- Relationship-based approaches based on Kraljic portfolio analysis
- E-procurement
- Use of Information Technology
- Pricing analysis based on TCO

Zycus (2008) proposed six steps to achieve procurement excellence as shown below.

- Identify Opportunities
- Win stakeholder support
- Achieve compliance
- Developing sourcing strategies
- Set goals and manage performance
- Make decisions, manage information and knowledge

It follows therefore that when identifying opportunities, the first step is to analyse spend. Therefore Zycus (2008) suggest the following

- Categorise and classify spend data. Pick areas where the organisation thinks it may have opportunities to spend.
- Then obtain purchasing and accounts payable data and analyse it to get a good picture of spend with suppliers.
- Next shift the focus into spend categories and analyse how much spend is occurring by purchase items e.g. laptop, mobile phone etc.

- Analyse opportunities for savings by consolidating suppliers.

The resulting value propositions typically are (Zycus 2008)

- Effective management of direct and indirect spending
- Standardisation of sourcing process
- Supply base rationalisation
- Reduction of supply chain risk

Van Weele (2010) proposes a more strategic approach towards purchasing excellence as defined below:

- Insourcing/outsourcing. The organisation must first decide what activities must be performed inside and outside the company.
- Develop commodity strategies. This requires a clear picture of the purchasing spend by commodity and supplier, or in other words spend analysis. A purchasing strategy must be defined for each commodity. The purchasing portfolio analysis could be used for this
- Establish and leverage world class supply base management. This should address the number of suppliers for a commodity, qualifications and conditions the suppliers should meet and the best way to select suppliers
- Develop and manage supplier relationships. To do this, suppliers must be grouped into distinct categories as a point of differentiation.
- Integrate suppliers in product development. Having selected the suppliers for key commodities, they must be engaged in new product development.
- Supplier integration into the order fulfilment process. A partnership must be developed to improve customer service, asset utilisation and efficiencies by performance management, communication and leveraging use of Information Technology.

Giunipero, Handfield and Eltantawy (2006) indicate that supply management professionals will assume a more strategic role in the future. The trends in supply management are Strategic relationships, Strategic cost reduction, Integrated systems, a greater focus on Total Cost and Strategic vs. tactical purchasing orientation.

In this section, a number of approaches are considered.

- It begins with a discussion on assessing the procurement maturity of an organisation.
- Understanding the spend is an important requirement and this requires classification of spend into relevant categories
- The process of getting the spend data or Spend Analysis is next
- Lastly the importance of understanding demand and supply power is discussed

3.5.2 Procurement Maturity

Cousins et al (2008) describe the four stages of strategic procurement maturity as follows. It is based on the model developed by Reck and Long (1988).

1. **Passive.** This is the poorest level where the purchasing function has no strategic direction and reacts to requests from other functions. It is characterised by
 - Large amounts of time spent on quick fix routine operations
 - Expediting shipments and invoices
 - Little interaction between departments. Low visibility and absence of end to end process integration
 - The performance drivers are mainly cost. Supplier selection based on price and availability
2. **Independent.** This is the first step towards strategic procurement.-Here the purchasing function adopts the latest techniques and practices, but its strategic direction is not linked to the organisation's competitive strategy.
 - The organisation realises the contribution of procurement to profitability
 - Performance measures are primarily cost and efficiency
 - The purchasing function starts co-ordinating with other functions.
 - Information technology is used to communicate with suppliers
 - Senior management recognise importance of procurement professional development.

3. Supportive. Here the purchasing function is performing at the “best in class” level. It supports the organisation’s competitive strategy by adopting techniques that strengthen its competitive advantage. The characteristics of such a function are:
 - Top managed consider procurement as an essential function and purchasing department is included in sales proposals.
 - Suppliers are considered an important resource and are carefully selected and motivated.
 - Procurement professionals are considered a resource with emphasis on experience, motivation and attitude
 - Purchasing team proactively monitor markets, products and suppliers and provide timely information to all concerned about changes that impact strategy
4. Integrative. For many organisations, stage 3 would be the zenith for its purchasing function. However it is possible to go further and become a key part of the organisations competitive strategy and make an active contribution.
 - The procurement team is attempting to be “one-step” ahead of its competitors and takes advantages of opportunities.
 - Procurement professionals are cross-trained in other functions and focus on strategic elements of competitive strategy
 - Permanent lines of communication with other functions exist
 - Purchasing performance is measured on a balanced scorecard and can directly be measured in terms of success.

3.5.3 Category Management

Category management is the practice of segmenting the main areas of “spend” on goods and services into discrete groups of products and services according to their function (O’Brien 2009). More importantly, it mirrors how individual marketplaces are organized.

In addition, it enables an organization to work cross-functionally on individual categories and examine the entire category spend and the usage of the products or services within the category, the marketplace and individual suppliers.

The Chartered Institute of Purchasing and Supply Management is of the opinion that ‘Companies are turning to category management strategies, combining standard sourcing and compliance procedures with process automation and improved data management and spend analytics to holistically manage the total costs of a good or service and its associated supplier relationships’ (CIPS 2010b).

The term ‘category management’ originated in the world of sales and marketing. The Nielsen definition of Category Management is that it is a process that involves managing product categories as business units and customising them [on a store by store basis] to satisfy customer needs (Buckingham 1993, Page 1). This definition still holds in Wikipedia.

The marketing professional looks at managing groups of products according to consumer usage with ‘a brand management perspective’ The purchasing professional on the other hand is the reverse of marketing and is looking at it from the perspective of what is being purchased from suppliers.

Kaipia & Tanskamen (2003) describe the execution of a category management process via a multistage process, which consists of defining the category and its role, establishing the measures for the performance of the category, determining the strategies and tactics and implementing them.

O’Brien (2009) goes further to describe two fundamental types of categories, direct and indirect. The direct category encompasses goods and services that are directly used in the final product, whereas indirect covers all other spend that are non-product specific.

On the other hand, some prefer to add a separate category for MRO (Maintenance, Repair and Overhaul) items. Each of these has different characteristics and opportunities and may need a different approach. Typically an organisation has better control over sourcing of direct materials but they pose more complex challenges and

require a higher level of granularity of categorisation. In addition, opportunities are more difficult to identify but the savings potential is higher. In contrast, indirect purchases and MRO categories are simpler to categorise and a standard classification like UNSPSC may be easily used (O'Brien 2009). It is more straightforward to identify opportunities for rationalisation as shown in Table 3.1.

Table 3.1: Spend Classification

	Direct	MRO	Indirect
Product Assortment	Limited to Large	Limited	Very Large
No. of suppliers	Limited	Limited	Very Large
Purchasing turnover	Very large	Medium	Limited
No. of purchase orders	Considerable	Medium	Very Large
Average Order Size	Large	Medium	Small
Purchase Control	Based on Forecast	Spares planning	Limited planning
Value	High	Low-Medium	Low-Medium
<i>Telecom Example</i>	<i>Network Hardware</i>	<i>Network Spares</i>	<i>Stationery</i>

Source: Adapted from Van Weele (2010)

Thus categories are identified by segmenting the spend into discrete commodities. However, O'Brien (2009) points out that a number of factors must be considered.

- Firstly not all spend is not addressable. Examples of such items are rates, taxes, GST etc.

- The Pareto principle also applies here. 80% of the third party spend is usually with 20% of the suppliers. This should be the prime focus for categorisation.
- Thirdly a good analysis and breakdown of the spend is required to begin the identification of categories. Hence the need for a spend analysis tool.
- In order to maximise the opportunities of category management, the segmentation must reflect their market-facing nature. This includes the type of items being purchased as well as the geographies from where they are sourced.
- The segmentation strategy must be planned very carefully. It must be large enough to find opportunities but small enough to work on.

Section 3.4.4 discussed use of a portfolio approach and the need for an appropriate sourcing strategy. Benton (2007) says that regardless of whether a single or multiple sourcing strategy is used, it is always desirable to reduce the overall supply base. He suggests using the grade or hurdle methods to guide the reduction process. With the “Grade” method, a score or grade is assigned to the suppliers in a category based on a selected attribute like price, performance, quality, innovation. The low scoring suppliers can then be weeded out. However this is based on past performance. The “hurdle” method is where suppliers go through a certification process to remain in business. The supplier certification process is based on quality and other criteria that are important for that category.

Routine items are of low value, are ordered frequently and therefore cause high transaction costs (Gelderman and van Weele 2005). Therefore, strategies aimed at reducing transaction costs through category management in e-procurement should be considered.

There are other aspects of category management apart from expenditure segmentation. It is a structured framework of activities that is designed to deliver superior procurement outcomes (CIPS 2010).

A typical category management process flow would include the following stages:

- Stage 1: Developing a thorough understanding of third party spend and future demand
- Stage 2: Segmenting spend into market sectors
- Stage 3: Developing market sector strategies
- Stage 4: Supplier selection
- Stage 5: Supplier performance management, including strategic supplier partnering

The strategic activities that have been described are applicable to both the supply of goods and services.

3.5.4 Spend Analysis

Category management requires that third-party spend be segmented into categories that can be worked on individually or by a cross-functional team, to identify and implement the optimum sourcing strategy for that category (O'Brien 2009).

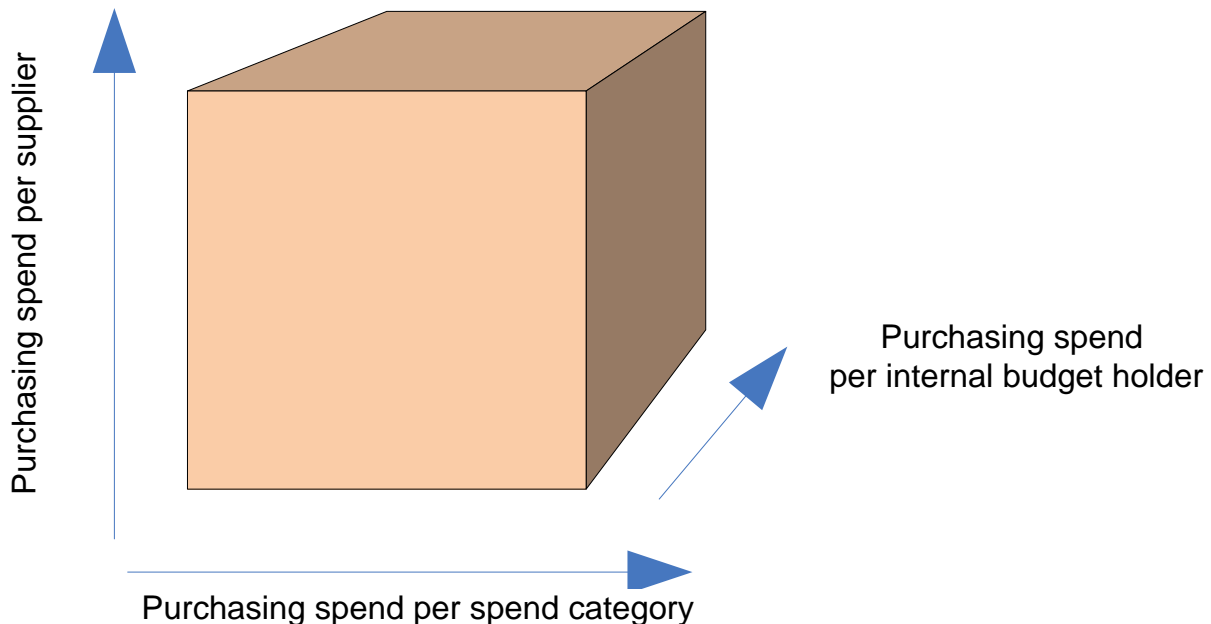
An Aberdeen Group (2001) study of spending analysis practices revealed that only a few firms truly know and understand how much they spend, on which products, and with which suppliers. Thus Spend analysis is the first and critical step in category management that helps in identifying saving opportunities.

Van Weele (2010) says that spend management should be the foundation for every purchasing strategy. He believes that the key to developing a good sourcing strategy is the collection of detailed spend management information, however most organisations find this the most difficult step and the information is not available without significant effort.

Van Weele (2010) proposes presenting spend information via a “purchasing spend cube” as shown in Figure 3.16 below. This cube allows visibility of spend in three dimensions, viz. purchasing segments or categories, suppliers and departments or internal budget holders. Depicting it this way will prove to be an indispensable tool for developing purchasing and supplier strategies.

In addition, Van Weele (2010) says that for a service company, purchasing for the primary process is almost nil since they do not have a production process. However they have a large diversity of products and services purchased like buildings, IT, labour, house-keeping, office supplies etc. He suggests building a customer/product category matrix to help develop a sourcing strategy. It requires building a purchasing spend cube as depicted in Figure 3.16 to analyse purchasing spend by product category by supplier by department.

Figure 3.16: The purchasing spend cube



Source: Van Weele (2010)

The success of any supply management program is largely dependent upon the ability to access, organize, and analyze spend data. It is also important for other activities like budgeting and planning, inventory management and product development. However, this analysis is difficult to achieve in most organisations and is not simple to extract out of an ERP system. A number of tools must be used to obtain it in a usable form. (Aberdeen 2004).

The Aberdeen (2004) report goes further to say that spend analysis can be performed at many levels. The topmost level is by supplier and while this identifies opportunities for consolidation, there is no visibility of the complete spending position. The next level is to break it down by commodity category by supplier. This can be used to obtain a deeper insight into spending by commodity. However, the most effective spending analyses are the result of data that is categorized at the item level, providing visibility and allowing comparisons of detailed attributes across suppliers and commodities. This allows analysis by company, division, site, buyer and product. However it requires sophisticated tools to extract the data.

Pandit and Marmanis (2008) say that spend analysis is the starting point for strategic sourcing. They describe spend analysis as a historical analysis of procurement information via supplier hierarchies, commodity alignment and spend amount to enable opportunities for savings. At a broad level, they classify spend into direct, indirect and MRO categories.

O'Brien (2009) recommends the following approaches to spend analysis.

- Data extraction. Use of IT systems to extract and transform data to provide a view of spend and segmentation of spend by category. It may be necessary to combine data from multiple sources.
- Interrogation of purchase orders: Review of historical purchase orders over a period of time, one by one, and recording and categorizing the spend for each to arrive at a final spend analysis snapshot;
- Asking the suppliers: Requesting a breakdown of spend by category for the past 12 or 18 months from key suppliers,
- Liaison with stakeholders or budget holders to understand what they spend in key areas;
- Analysing finished goods and volumes shipped, to derive raw materials and input volumes and thus calculate spend data;

The authors own experience in implementing ERP systems in a number of organisations confirms that spend analysis reporting is not easy to obtain even when organisations use ERP systems. The reason is that it involves analysing millions of

base transactions from a number of systems in order to provide meaningful reporting. Examples of these are Accounts Payable, Purchasing, e-procurement, materials management, P-cards, MRP, and SRM etc. The hurdles are not technical. They mostly relate to the lack and disparity of the data quality (both master and transactional). Even organisations that have had ERP systems face a challenge as the data models were not designed to cater for this type of analysis. Thus in order to have a usable spend analysis reporting, the data must be extracted, cleansed, enriched and transformed before it is loaded into a data warehouse from where it can be analysed.

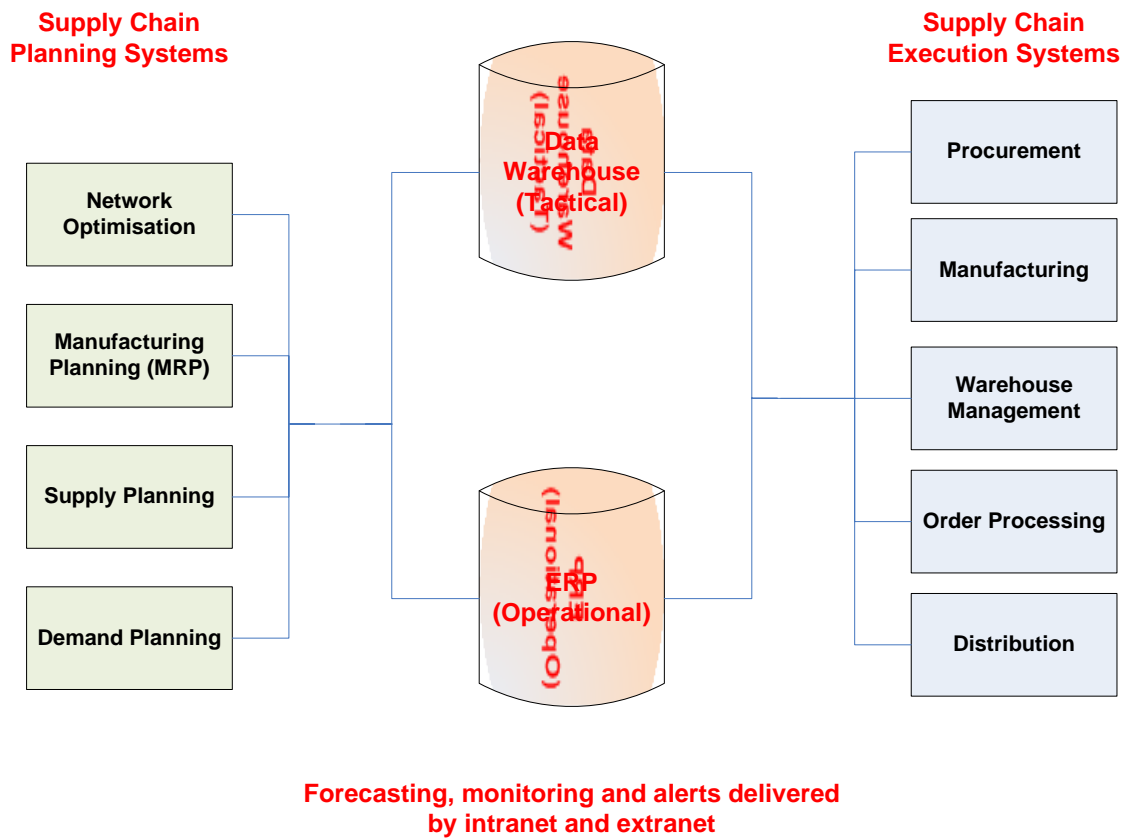
3.6 Leveraging Information Technology

3.6.1 Information Technology Opportunities

Information Technology is an important enabler for designing and managing an effective supply chain. It typically spans the entire enterprise and beyond, embracing customers at one end and suppliers at the other end. When designing strategies to reduce costs and lead-times and increase service levels, the importance of having timely and accurate information cannot be stressed enough (Simchi-Levi et al 2008).

Information Systems operate in strategic, tactical as well as operational levels. Almost every large organisation uses ERP (Enterprise Resource Planning) systems. Many also use CRM (Customer Relationship Management) and SRM (Supplier Relationship Management) systems to manage external relationships and exchange of information (Chopra & Meindl 2007).

Chaffey (2009) describes a typical IS infrastructure for supply chain management. Applications can be categorised as planning or execution (Figure 3.17). The key feature of the infrastructure is the central operational database (an ERP system like SAP, Oracle, Peoplesoft, Baan) that allows information sharing between the various supply chain processes. The data warehouse provides the reporting and enhanced visibility.

Figure 3.17: Typical IS infrastructure for SCM

Source: Chaffey (2009)

From a purchasing and supply management perspective, the landscape has changed rapidly over the last few years, as a result of the Internet and computerization. Organisations are increasingly moving routine transactional processes to computer based platforms to gain efficiencies, reduce costs and better utilise staff. Not only does it provide capability to perform a plethora of tasks and reports within an organisation but they also play a big role in integration with other organisations.

In the procure-to-pay process itself, a number of processes can be automated.

- ERP or Enterprise Resource Planning Systems. Internal processes starting from requisition and purchase order generation, quotation, bidding, order tracking, expediting, supplier payment and performance measurements. The benefits of such an approach are process compliance, integration with other areas of the business, increased productivity and reduced cycle times all of which can

indirectly result in financial gains. Telecom NZ already uses SAP for this purpose.

- E-Sourcing. Tools are widely available to time buying decisions based on market trends in pricing and availability. Web-based sourcing using tools that automate and speed up many of the more tedious procurement processes such as requests for information (RFIs) and requests for proposals (RFPs) and contract management has enabled organizations to improve their supplier selection and reduce prices through standardization methods that would otherwise be cost prohibitive.
- SRM or Supplier Relationship Management systems.
- Advanced Planning Systems. Buyers and suppliers can share in benefits through the transparency of supply capacity and product demand, producing greater collaboration and alignment between their organizations. This can result in savings for both.
- Materials Requirements Planning or MRP to plan and manage operations and control inventory. Telecom uses this for network spares planning.
- E-Procurement to exchange procurement specific data between organisations. Examples are Electronic Data Interchange or EDI, marketplaces, exchanges etc. Telecom uses EDI with some suppliers.

Carr and Kaynak (2007) indicate that traditional communication methods, information sharing within a firm, and information sharing between firms, and supplier development are significant factors for improving a buyer's performance. Thus information technology can play a significant role in improving supplier relationships.

However, technology is not everything. Sammon and Hanley (2007) found that while benefits can be realised from creating an e-supply chain, organisations need to ensure a common understanding and definition of what it is striving to achieve. The implications and benefits need to be properly understood and metrics for measurements must be defined before organisations forge ahead.

Cohen and Roussel (2004) describe the need for an organisation to align its supply chain strategy with the business strategy to achieve excellence.

Ogden et al (2005) conducted a study on procurement and supply management strategies that would lead to significant improvements over the next 5–10 years. They concluded that strategies such as increased integration, information sharing and collaboration among supply chain members are most likely to be implemented and would have the largest impact on organizations. Additionally, they argue that this integration will not include joint investment or asset sharing, will be limited to one tier in the supply chain, and will not heavily involve e-markets and electronic auctions.

Kohn, Saad and Arunachalam (2006) say that one must not rely solely on ERP systems to manage the supply chain. An effective purchasing function is also necessary for success. Whilst the main value of ERP is the integration of supply chain and financial processes, ERP itself does not deliver supply planning and demand planning functionality. However, the integration of SCM and ERP gives an organisation the opportunity to build effective processes with suppliers they trust, so they can get the maximum return on relationship with all their suppliers on a continuous basis.

3.6.2 Impact of Information Technology on Performance

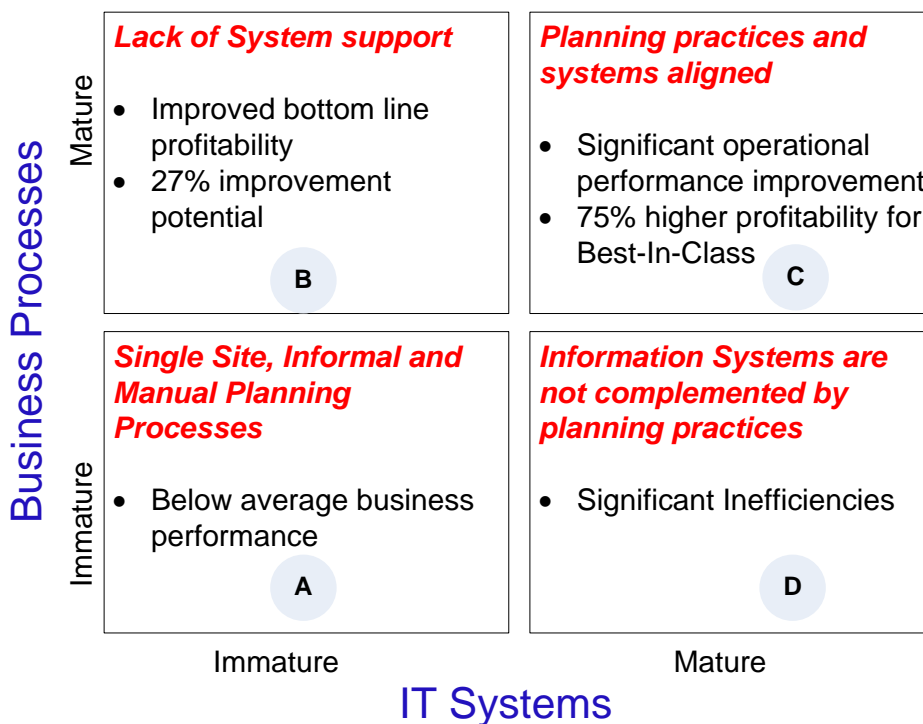
Auramo, Kauremaa and Tanskanen K. (2006) found that successful companies have focused e-business solutions for improving customer service elements that are important to their business. It also improved efficiencies to free up personnel to focus more on critical business activities. Furthermore, the use of e-business solutions improves information quality and support planning collaboration and improved agility of the supply network. They caution that the use of IT has to be coupled with process redesign to gain the desired benefits.

Heinrich and Simchi-Levi (2005) studied 75 different supply chains and concluded that there is a link between IT strategy, sound business processes and supply chain performance. Their key findings were

- Companies with mature business processes have lower inventory levels and achieve superior financial performance. However the investment in business processes must be accompanied by a suitable investment in IT systems to harness the best performance.
- They also found that companies that support their demand planning process with a relevant software module shorten their order fulfilment lead time by 47% and almost halve their cash-to-cash cycle time.
- Companies supporting the supply planning processes with IT systems reduce inventory days of supply by almost 40%.

They summarise their finding in a matrix that assesses business process maturity against the IT systems (Figure 3.18)

Figure 3.18: Linking Processes and IT Systems



Source: Heinrich and Simchi-Levi (2005)

The findings indicate that companies in quadrant A are characterised by immature processes and systems. They would typically have a unsatisfactory business performance, high inventory levels, high cash to cash cycle times and low profitability.

On the other hand, companies in quadrant C have mature systems and processes and these supply chains attain significant performance levels. These are the supply chain leaders and are “Best in Class”. The performance gap is remarkable.

To further stress the importance of business process, consider the following example for the S&OP (Sales and Operations Planning) process. Bower (2006) claims that a “best-in-class” S&OP implementation results in a 14% increase in operating margin, 4% increase in gross margin, 55% reduction in inventory write-off and a 17% increase in new product revenues. Isn't that impressive?

Chaffey (2009) describes the typical benefits of integration and use of technology

- Upstream supply chain management. Use of technologies like e-procurement can result in increased efficiency of individual processes, reduced cycle time and cost per order
- Downstream supply chain management. Use of technologies like B2B to support order fulfilment, outbound logistics can help increase process efficiencies, improve sales response, reduced cost of channel distribution and sales
- Planning. Use of technology for supply chain planning can help reduce inventory and result in an adaptive supply chain. Examples include Demand and Supply Network Planning using Advanced Planning Systems (APS), CPFR, VMI.
- In addition there is a whole host of technologies like Business Intelligence, RFID, bar-coding, workflow that can result in cost reductions and speed up processing.

Simchi-Levi et al (2008) state that it is very important for organisations to consider the goals of the IT system in their supply chain. The key goals should be

- **Collect Information.** The primary goal of an IT system is to link the point of production with the point of delivery or purchase. Thus its ability to collect information and provide visibility of each product throughout the chain is vital.
- **Access Data.** The goal of an IT system should be make all the necessary information consistently available from a single point of contact.
- **Analysis based on supply chain data.** The system must be able to provide the information necessary to analyse and operate the supply chain. In other words it must provide the most efficient ways to purchase, assemble, product, store and distribute products.
- **Collaborate with supply chain partners.** Lastly the system must have the ability to integrate with suppliers on the one hand and customers on the other hand to result in an efficient and effective collaboration.

It may not be practically possible to achieve these goals at the same time and they are not necessarily dependent on each other. However each goal should be carefully considered, prioritised and actioned.

3.6.3 E-Procurement

Supply chains are traditionally supported by information technology (Kalakota & Robinson 2001). With the implementation of ERP systems in the 1980s, EDI connections with suppliers were established. The potential of e-procurement has already been proven in a number of studies. According to these studies, e-procurement enables companies to decentralize operational procurement processes and centralize strategic procurement processes as a result of the higher supply chain transparency provided.

E-procurement enables the procurement process between a buyer and a supplier to occur in a faster, more efficient manner and with fewer errors. These methods include electronic data interchange (EDI), marketplaces, supplier portals or other techniques. No matter what method is used, there are many advantages to using e-procurement systems as opposed to traditional paper-based communications.

Generally, the entire cycle comprising of forecasting, sourcing, ordering, receiving, paying and evaluation are collectively termed e-procurement. Some may argue that they each have their own specialist terminology viz. SCM for forecasting, e-sourcing for RFX, sourcing activities, e-purchasing for requisitioning and ordering activities, EIPP (Electronic Invoice Presentment and Payment) for the invoicing cycle, but this is collectively termed E-Procurement.

The Chartered Institute of Purchasing and Supply describes E-procurement as using the Internet to operate the transactional aspects of requisitioning, authorising, ordering, receipting and payment processes for the required services or products. (CIPS 2010). Similar definitions are provided by other leading organisations like Aberdeen, SAP, Oracle etc.

Over the last few years, e-procurement implementations have experienced an explosive growth in some organizations, while others have resisted. According to a recent e-procurement benchmark report by the Aberdeen Group, (Minahan, 2004), organizations have been able to reduce off-contract spending by 64%, requisition-to-order cycles by 66%, and requisition- to-order costs by 58%.

The main benefits are reduced transaction costs, increased efficiency, cost savings, standardisation and greater efficiency in the purchasing process, reduction of indirect operating costs, reduction of lead times and inventory costs etc. Business transactions occur in less time and with fewer errors. They also reduce postage, risk and other expenses related to storage of paper. When used effectively, it also reduces the amount of inventory held allowing for just-in-time delivery. (Neef 2001).

Santema and Kopecka (2006) researched the value of E-Procurement on the EVA (Economic Value Add) of a company. Their conclusion was that value is derived from decreased, tactical purchasing costs as a result of increased efficiency and reduced purchasing price as a result of identifying new sources of supply.

In their study on the effects of business-to-business relationships on electronic procurement systems, Nagle et al (2006) made an attempt to classify e-procurement models according to their characteristics. Table 3.2 describes the common characteristics of e-procurement models as follows

1. The Nature of the Model. This can be buy-side, sell-side or neutral. Buy-side is when there are many suppliers to one buyer with benefits more focused towards the buyer. Sell-side is when there are many buyers to one supplier and trading is carried out through the supplier’s web site. The third is to have a neutral or third party emphasis where transactions are carried out between many buyers and many suppliers through a neutral web site.
2. Type of procurement it supports. Types of procurement include centralised, decentralised, systematic, spot, direct and indirect. Centralised procurement is where professional buyers make decisions on the items to be procured. In decentralised procurement employees order products from their own PC, but it is subject to approval. Systematic procurement is planned and occurs on a regular basis where as spot procurement is ad hoc.
3. Aggregation Type. Three models are described, viz. 1-to-1, 1-to-many and many-to-many based on the initiator and number of parties involved in the transaction.
4. Product Types. Direct or indirect products can be purchased via e-procurement.

Table 3.2: Summary of E-Procurement Models

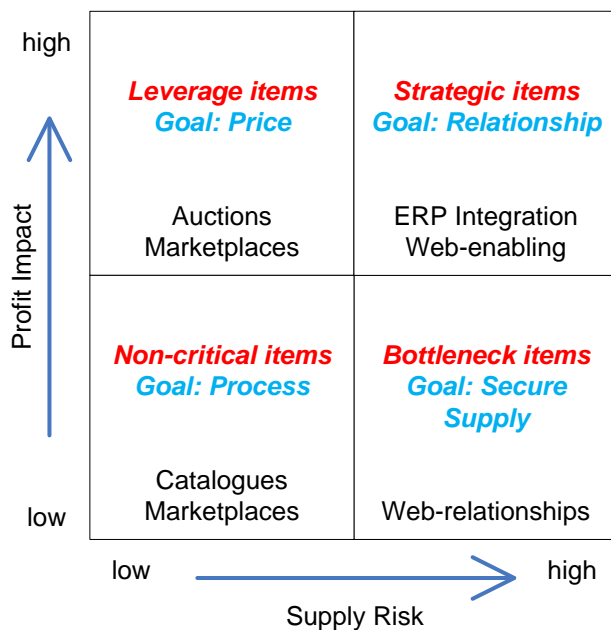
Model	Market Focus		Types of Procurement				Buyer/Seller Aggregation			Product Type	
	Buyer/Seller Centric	Neutral	Centralised	Decentralised	Spot	Systematic	1-1	1-Many	Many-Many	Direct	Indirect
Electronic Auction	√		√		√			√		√	√
Electronic Catalogue	√			√		√		√			√
Electronic Exchange		√	√		√				√	√	√
Content Hub		√				√			√	√	√
EDI/XML Extranet	√		√			√				√	

Source: Nagle et al (2006)

Their study concluded that the nature of the e-procurement is affected by the buyer-supplier relationship.

Santema and Reunis (2003) explored the use of various e-procurement strategies as a purchasing behaviour against the Kraljic portfolio model described in section 3.4.4. They prescribe the following strategies, which is depicted in Figure 3.19.

Figure 3.19: E-procurement goals and examples



Source: Santema and Reunis (2003)

- For the routine quadrant, the goal of e-procurement should be to reduce the cost of the purchasing processes. The type of e-tools or e-procurement that can be found in this segment are marketplaces and catalogue buying.
- In the leverage quadrant, the reduction of product prices is the typical goal of using e-procurement instruments. Auctions and marketplaces would be the most common option to achieve this. Suppliers could be invited to a reverse auction or other online negotiation mechanism to achieve a significant price reduction.
- For the strategic quadrant, establishment of supplier relationships is often the objective. E-procurement could contribute to simplifying or enabling the

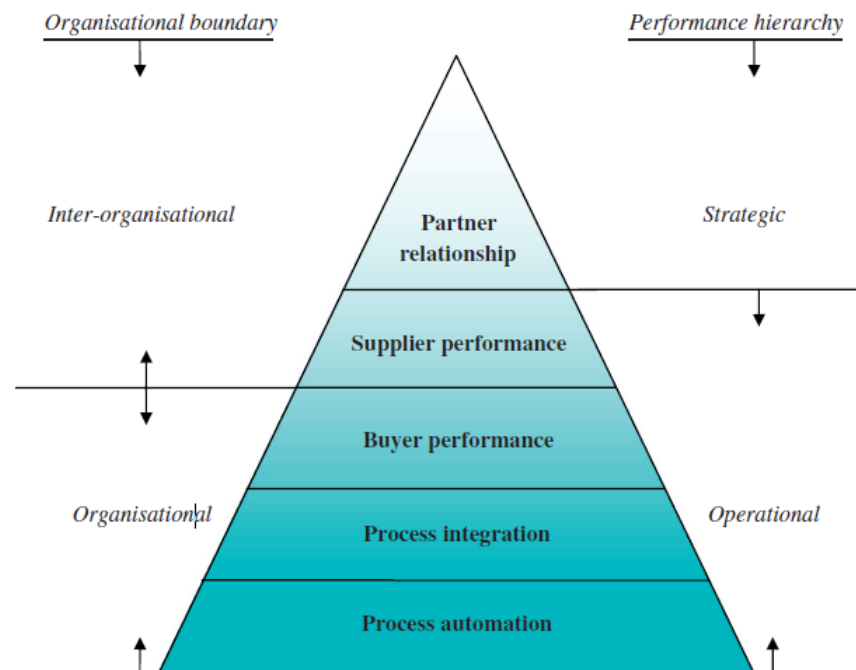
relationship. B2B via ERP or web-enabled integration would be the likely e-procurement tools to be used.

- For bottleneck products, ensuring the supply of items is essential. It would be beneficial to use e-procurement for used for the supply processes and not for purchasing activities for these products. Track and trace applications play an important role here to enable visibility of the critical parts in the supply chain. This can be achieved by providing visibility of the purchase order status and expected delivery date of the goods or services.

Organisations typically begin their E-Procurement initiative by sourcing indirect goods. The Aberdeen Group (2001) found that about 30-60 percent of a firm's total expenditures are due to purchases of indirect goods/services.

There are many forms of E-Procurement. Prior to Internet era, electronic data interchange (EDI) was the most common method and was most commonly used for procuring direct materials. However, the cost of implementation and maintenance is high and it can be justified only in large organisations where the transaction volume is high. (Tai et al 2010).

Nowadays, most traditional e-procurement has evolved into web-based e-procurement. Tai et al (2010) claim that the emergence of Web-based e-procurement will not only reduce the cost of the purchasing process but also transform it from an operational into a strategic activity. They claim that a Web-based e-procurement system can generate operational and strategic benefits at the organisational and inter-organisational level as shown in Figure 3.20.

Figure 3.20: Impact of E-Procurement

Source: Tai et al (2010)

Tai et al (2010) argue that firms that implement a web based e-procurement system target five performance outcomes.

- Buyer immediate measure
- Buyer integrated process
- Buyer organisational performance
- Supplier performance, and
- Partner relationship.

As per their study, they claim that the operational benefits are obtained through automating the procurement process, re-engineering the internal processes of the organisation and sharing of information in the transaction context. The strategic benefits are generated by strengthening the buyer–supplier trading relationship.

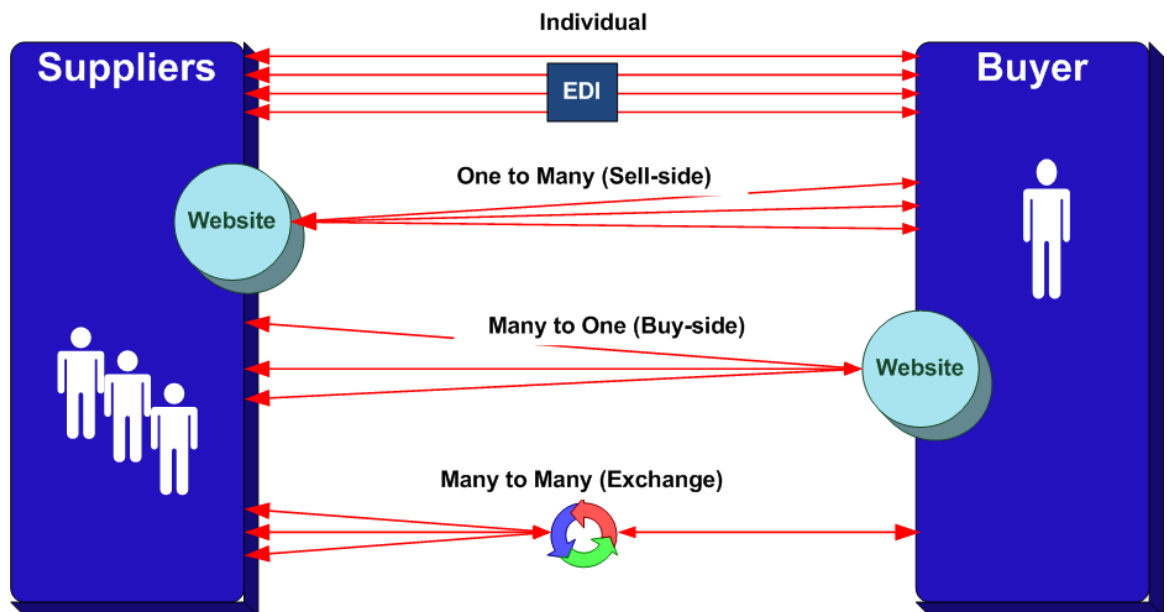
Implementing e-procurement is not without its challenges as reported by Chaffey (2009).

- Adoption by Supplier. There can be resistance from suppliers because of competition, negative perception, increased cost for catalog creation and other information exchange and associated process changes.
- Implementation challenges. Within the organisation there can be training and change management issues, management of catalogues and project management issues.

The traditional approach was to use EDI wherein a specific interface was built between the buyer's procurement system and each supplier's sales system. With Internet based options, there are three main e-procurement models (Chaffey 2009). Each has their advantages and disadvantages as described below.

- One-to-many or Sell-side is driven mainly by suppliers and allows multiple purchasers to tap into catalogues and processes set up by suppliers. The purchase is made directly from a seller's website that is typically not integrated with the buyer's procurement system.
- Many-to-one or Buy-side involves a single buyer establishing an Internet based purchasing programme with many of its suppliers, normally through a centralised e-procurement structure. In this approach, the seller's catalogues are integrated with the buyer's procurement system.
- Many-to-Many or exchanges also known as marketplaces where many buyers and sellers come together to trade and involves trading through an intermediary. This may or may not be integrated with the buyer's procurement system.

The options are depicted in Figure 3.21

Figure 3.21: E-Procurement Options

Source: Author

3.7 Supplier Management

3.7.1 Supplier Relationships

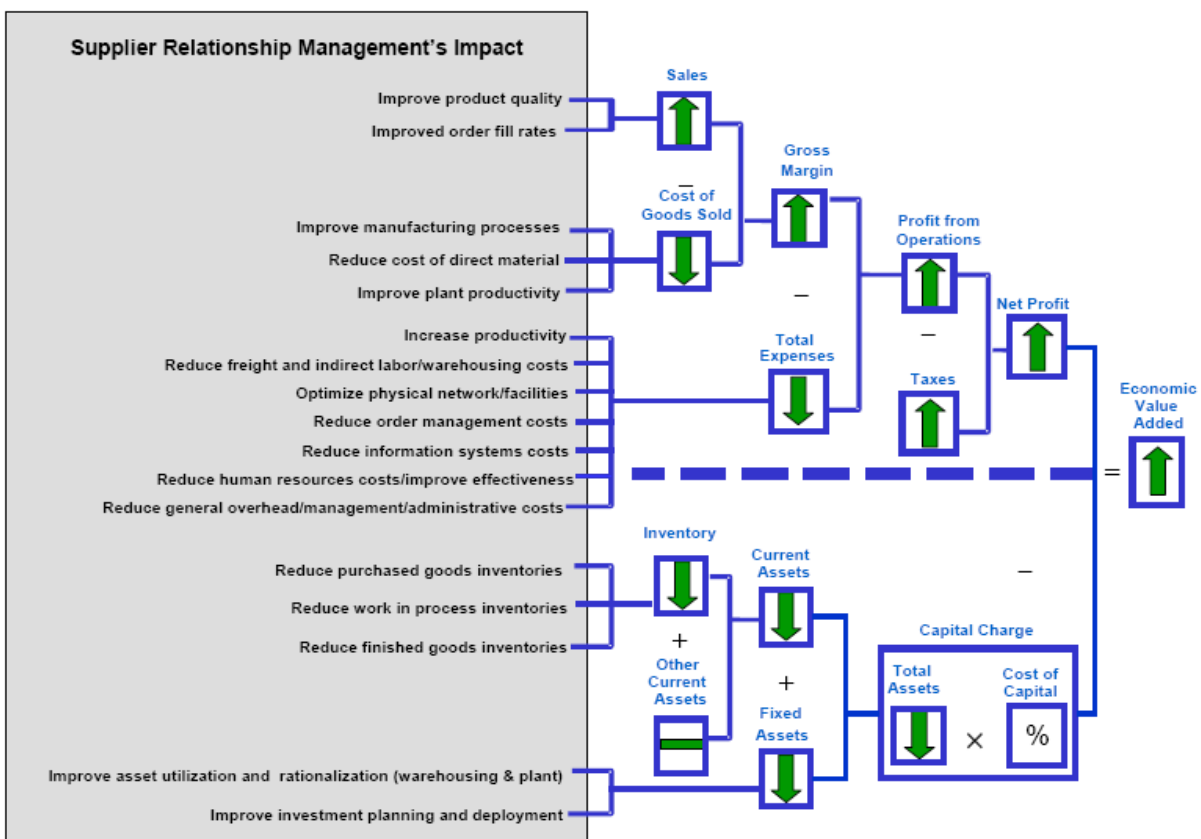
One of the most important aspects of supply management is the relationship with the supplier. This is guided by the importance of the supply source and its strategic nature to the organisation. Nicholas (1998) describes a traditional and partnership approach to supplier relationships by comparing the following characteristics:

- Purchase Criteria
- Design Source.
- Number of Suppliers and business volume.
- Agreement Type and Terms.
- Customer-Supplier Interaction.

Telecom NZ regard relationships with key equipment suppliers to be more strategic as compared to suppliers of office products and services.

Lambert and Pohlen (2001) state that supplier relationships affect the EVA of an organisation as depicted in Figure 3.22. The value of the supplier relationship may produce increased revenues through cost reductions, lower consumer prices, and improved quality obtained by working with a select group of suppliers. The cost-of-goods-sold (COGS) may be reduced through the leveraging of larger buys with a smaller number of suppliers. Expenses could decrease as the supplier assumes responsibility for order placement and inventory management. Pushing the ownership of inventory backwards to the supplier reduces inventory carrying costs for the customer and the supply chain.

Figure 3.22: Impact of Supplier Relationship on EVA



Source: Lambert and Pohlen (2001)

Simchi-Levi et al (2008) state that relationships between suppliers and buyers can take many forms, both formal and informal but to ensure adequate supplies and timely deliveries they typically agree on supply contracts. They argue that these contracts can be used as powerful tools to achieve optimisation, to better manage the trade-off between cost and risk and to motivate supply chain parties to reveal the true forecast of customer demand. They discuss the effectiveness of different contract types (buy-back, revenue-sharing, quantity flexibility and sales rebate) with the appropriate type of supply chains (make-to-stock, make-to-order) etc. They also review the effectiveness of these contracts vis-à-vis the strategic nature of the products. In addition, they review the integration between the various parts of the supply chain and the variability of the forecast. The impact of the bullwhip effect is well-known and effective strategies for dealing with it in the NZ telecommunications industry needs to be understood (Simchi-Levi 2008).

Further Simchi-Levi et al (2008) describe an effective framework for analysing strategic alliances. An important component is to consider how the alliance helps improve an organisations capability by:

- Adding value to products
- Improving market access
- Strengthening operations and reduced system costs and cycle times
- Adding technological strength
- Enhancing strategic growth
- Enhancing organisational skills
- Building financial strength

On the other hand, the potential downsides must also be considered

- Weakening its core strength
- Diminishing its core differentiation if key technology is shared

Cousins et al (2008) state that with the advent of outsourcing and supply base reduction, organisations have developed closer relationships with suppliers. This makes the suppliers even more important to the buyer for cost reduction, quality,

delivery performance and new product development. They recommend supplier development as a means of meeting cost reduction goals.

Cousins et al (2008, Page 76) describe supplier development as “any effort of a buying firm with a supplier to increase its performance and/or capabilities and meet the buying firm’s short and/or long term supply needs”. The process involves identifying critical suppliers and forming a cross-functional team with the supplier. The following best practices in supplier development are suggested.

- Buying from alternative suppliers to generate competition
- Performance evaluation
- Raising performance expectations
- Recognition and rewards for exceeding expectations
- Promises of increased business on performance improvement
- Training and education of supplier’s personnel
- Site visits to suppliers premises
- Forming integrated teams to help solve problems, future roadmaps, new product development

3.7.2 Supplier Performance

Organisations must periodically evaluate their suppliers and provide them feedback on performance, problems, opportunities and areas that need improvement (Nicholas 1999). For best results, they must be based on quantitative ratings as it leaves no room for ambiguity. Suppliers that score well on evaluations must be given special recognition and rewards whereas those whose performance is mediocre should be decertified. Gordon (2008) refers to the Aberdeen’s Supplier Performance Benchmark Report and claims that companies that manage supplier performance have much higher on-time delivery, quality and service levels than those that don’t.

Monczka, Trent and Handfield (2005) found that most measures fall into one of the following categories

- Price performance. The most widely used measure includes actual purchase price versus planned price comparisons and actual price compared to a market index.
- Cost effectiveness. This is useful when embarking on cost reduction programmes and comprises of processes to measure cost change or reduction as a result of improved supplier cooperation.
- Quality. This is commonly measured in terms of defects and failure rates by supplier or as a percentage of volume supplied.
- Delivery Time/Performance. This includes measures like On-Time/Delivery Responsiveness, cycle time reductions, introduction of new products etc.
- Technology/Innovation. This involves measurements like first insights/New technology where a supplier shares its new technology.
- Physical environment and safety. This is an important issue nowadays with companies tracking safety goals and compliance standards.
- Asset management and integrated supply chain measures. This involves tracking of inventory measure to achieve inventory cost reduction.

Trent and Monczka (1999) stress the importance of supplier evaluations by asking a series of questions regarding an organisation's sourcing practices. The key questions are:

- Is supplier performance being measured?
- Are aggressive performance improvement targets being established? This requires suppliers to establish even stricter goals as regards quality deliverables. Performance measure systems combined with aggressive supplier improvement targets are essential to promote supply chain improvements.
- Is superior supplier performance and improvement being rewarded? Trent and Monczka (1999) state that organisations should not hesitate in rewarding superior performance to achieve world-class supplier quality. There are a number of ways that this can be done and the encouragement it generates in the supplier can perpetuate a cycle of improvement.

Supplier quality is a key area that is very much neglected. Krajewski, Ritzman and Malhotra (2007) found that most companies must spend the appropriate time, effort and expense to improve the performance and quality of their processes if they wish to avoid significant losses. These costs can be broken down into four major categories, prevention, appraisal, internal failure and external failure. This can be achieved by use of techniques like TQM or Six-Sigma. Similarly involving suppliers early in new product development goes a long way to improve product quality.

Performance measures can be broken down into areas mentioned below (Cavinato and Kauffman 2000).

- Contribution to profit. Purchasing can contribute to profit by improving prices. Any saving in materials purchases goes straight to gross margin. This can be done by examining the total cost to buy which includes Delivery lead time (longer lead times lead to higher inventory costs), incoming inspection, logistics and rework.
- Quality measures. The goal should be receipt of defect-free goods and services. Fields data on failures, returns, rework, scrap, repairs must be gathered for this and discussed with the supplier.
- Delivery measures. This has direct ties to other measures like inventory planning, scheduling performance, cash flows, and customer service. To allow delivery performance to be accurately measured, predetermined delivery dates must be established for each item on the PO.
- Other Measures. Some measures of service are also related to delivery, quality and profitability. Whilst they are subjective in nature, it should be included in the measurement process. Examples of such measures include accurate recordkeeping, participation in development programs, flexibility, responsiveness to changes.

Gunasekaran et al. (2001) developed a framework for measuring performances of strategic, tactical and operational levels in supply chains. They recommend that performance measures in supply chains should strongly link to strategy and also have a balanced approach between the financial and non-financial aspects. In addition, they stress the importance of partnership evaluations in supply chains.

The measures they propose are linked to the SCOR processes of plan, source, make and deliver. They further classify the measures into strategic, tactical and operational levels of management. They are also distinguished as financial and non-financial so that a suitable costing method can be used. In a subsequent study, Gunasekaran et al. (2003) refined the above framework and tested it in a number of organisations.

A significant portion of the procurement activity in Telecom is project based. Examples include installation of equipment for broadband, commissioning fibre-to-the-home etc. Managing supply chain performance of a project is a different kettle of fish as compared to regular management. Wickramatillake, Koh et al (2007) identified eight key concerns relating to supply chain performance measurement of a large-scale project: performance measurement requirements, with forecasting and progress reporting not owned by suppliers; lack of detailed planning causing regular changes to baseline; detailed work breakdown structure causing unnecessary complications to performance analysis; organisational structure; performance measurement tool; data capture; timing of progress and cost capture affecting the analysing process; and scope change and traceability.

The recommendation is to have clear requirements, having a robust work breakdown structure, well-documented procedures; data capture discipline and change control.

Supplier performance evaluation cannot be one-sided. An important aspect of the review is the timeliness of payment to the supplier. This must be in accordance with the terms agreed in the contract. Late payments are a source of friction between buyers and suppliers and can result in jeopardising supplier relationships as well as breaching contract terms. It is important for procurement to be aware of all payment problem and issues with suppliers (Emmett and Crocker 2008).

3.8 Summary

Procurement is an important part of the supply chain and must be integrated through the strategic, tactical and operational levels in an organisation. For a supply chain to function efficiently, purchasing is important to meet a number of key objectives.

- Not only must goods be delivered on time and with least waste but the cost must also be commensurate with the risk pertaining to the supply market and the product.
- It requires a shift from a focus on transactions, short-term relationships and price, to developing leading-edge supply strategies, pursuing early supplier involvement, practising cross-enterprise relationship management and striving to achieve the lowest total cost for goods and services.
- Thus there must a concerted move towards supply management

Schuh et al (2009) describe the challenges faced by buyers today and claim that many companies find themselves “between a rock and a hard place” in terms of purchasing (Page 1). There is a predominant shift to a sellers market and buyers are faced with increasing costs coupled with insecurity of supply.

Telecom New Zealand is a key player in the country’s telecommunication industry. The telecommunications industry is at the forefront of technology and has a very short lifecycle. It introduces new products in collaboration with its suppliers periodically. Supply chains that involve their suppliers early achieve on average a 20% reduction in material cost, a 20% improvement in material quality, and a 20% reduction of development time (Monczka, Trent, & Handfield, 2005).

The author’s view is that with the economic crisis and recession at the turn of the year 2009, supply management has gained momentum in many organisations as the pressure is on to cut costs and make a positive impact on the bottom line. This is evident in the topic of research journals like Purchasing and Supply Management, SCMR, CIPS and other supply chain conferences.

Based on the literature review, there are a number of ways to help reduce procurement costs. Depending on the conditions, some are more effective than

others. The following techniques are considered in this research to influence procurement costs. They are

- Category Management
- Information Technology
- Supplier Relationships
- Supplier Performance
- Supply chain Modelling and Analysis

Using a purchasing portfolio like Kraljic's matrix can deliver a number of benefits to Telecom, the key ones being

- It would provide a basis for using a particular strategy for a category / commodity.
- It would force some rigour in the development of supply strategies, whilst making sure that the background research has been carried out.
- For a given strategy, it would help assess the relevant supplier management programs, organization structure and skills and performance measures.
- It would assist in the usage of the relevant IT / E-procurement strategy.

Supplier performance evaluation cannot be a one-sided process. Suppliers have to rely on key information from their customers to be able to provide quality goods or service. Hence if they receive late orders or have changes to orders after the cut-off time or changes to project scope or incorrect forecasts their ability to provide quality goods or services. Hence any evaluation process must also consider this aspect.

3.9 Literature and Current Study

The literature review covered a number of ways to achieve procurement efficiencies, the significant ones being

- Purchasing Process Review
- Purchasing Portfolio
- Category Management
- Spend Analysis

- E-Procurement
- Supply Chain Mapping

In the review a number of gaps were identified.

- What was required for this study is a “toolbox” to conduct a review that would help identify the key problem areas and recommend opportunities for improvements. This would then allow Telecom to assess and prioritise the recommendations and then plan a programme of work for detailed analysis and implementation.

The journal articles and books contain a lot of detailed information specific to addressing a problem. However it was difficult to find information that could be used in this diagnostic process. This study addresses this gap and formulates an approach to meet this need.

- Specifically for E-Procurement, there were a number of papers. However, they mostly address the needs of the US or European markets or just address one particular aspect of electronic communication like adoption.

However the situation for this study was different. Telecom NZ already has an ERP solution and already use some form of EDI. Moreover, the New Zealand market is small and the volumes do not justify expensive solutions. What was required was a multi-tiered approach to selecting the appropriate technology to meet specific needs. This study addresses the need and proposes a multi-tiered approach to selecting an E-Procurement solution.

- Supply Chain Modelling using SCOR has been discussed in many papers. However most address manufacturing industries. This study shows how this can be done for a telecommunication industry and uses some key SCOR metrics.

Thus this study attempts to use a few tools and techniques distilled from the wealth of information that was available.

Chapter 4. Research Methodology

4.1 Introduction

This chapter begins with the illustration of the underlying philosophy and research approach and method that is used. It serves as a basis to further identify the data collection approach, process and analysis that is best suited for this research.

Supply chains present a number of challenges to the researcher mainly due to their very broad scope and multi-functional perspectives. (Koulikoff-Souviron & Harrison 2005). Thus it is imperative that a suitable research methodology be used.

It provides an explanation of the steps used in selecting the case study as the final strategy.

4.2 Research Objectives

According to Yin (2003), the research objectives state the goal or what is to be accomplished by conducting the research and how the results can be used.

As mentioned in Chapter 1, the objective of this research is to identify avenues for efficiency and cost reduction in the supply chain from a procurement perspective for a New Zealand based telecommunications organisation. To achieve this, the following preparatory steps are required

- Review the current procurement processes and identify avenues for efficiency gains
- Identify spend patterns to conduct effective supplier base analysis
- Explore how procurement performance is measured
- Leverage use of Information Technology to reduce costs
- Model and analyse the supply chain to assess the current state of performance.

The fixed networks business unit has been used as an example to achieve this.

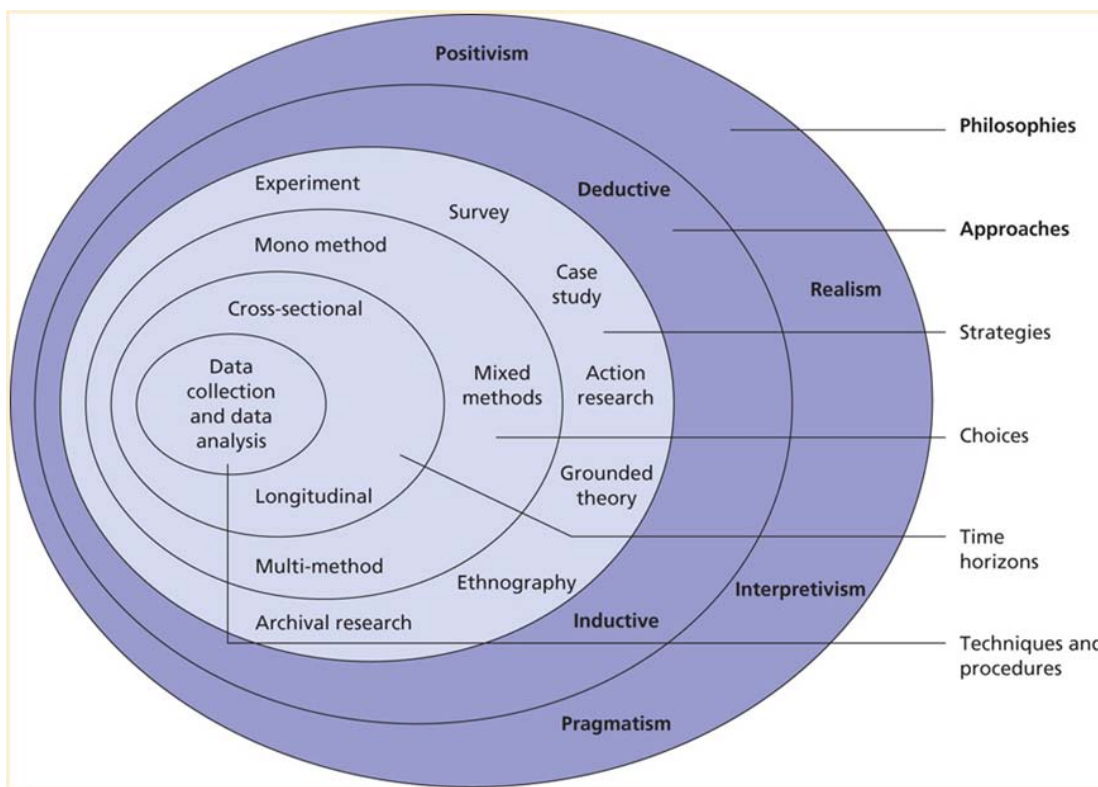
4.3 The Research Process

4.3.1 Overview

After identifying the scope of this study in the previous chapters, it is then important to identify and select the most appropriate research methodology to be applied for this study. A number of aspects need to be considered before finalising it. The “research onion” process developed by Saunders, Lewis and Thornhill (2009) has been used as a logical outline for conducting this research.

In order to come up with the most suitable research approaches, Saunders et al (2009) suggest use of the research process “onion” as shown in Figure 4.1. This is because conducting a research is like peeling the layers of an onion. Therefore, in order to come to the central issue of how to collect the necessary data needed to answer the research questions and objectives, the primary important layers should be first peeled away.

Figure 4.1: The Research Onion



Source: Saunders, Lewis and Thornhill (2009), page 108

The research process “onion” consists of six layers. As approaches in the different layers have dependencies, the authors suggest that a research design should be developed from the top down, starting with the outside layer [the philosophy] and thereafter peeling away each layer until the sixth layer is reached [the data collection methods].

4.3.2 Research Philosophy

The over-arching term research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders et al 2009). It contains important assumptions about the way in which the researcher views the world.

This aspect is also referred to as research methodology by other experts. The research methodology provides the reasons for using a particular research type based on the research questions. It shows how the research questions are articulated with the questions asked in the field thus providing a kind of justification to the process used. It is thus the researcher’s task to identify the research tools and the rationale for the selection (Clough & Nutbrown, 2002).

Saunders et al (2009) describes four research philosophies, viz. positivism, realism, interpretivism and pragmatism. He also considers three aspects of research philosophies, viz. ontology, epistemology and axiology. They are inter-twined and need to be considered together.

- Ontology is a branch of philosophy that is concerned with the nature of social phenomenon as entities and describes the researcher’s view of the nature of the reality or being. There are two aspects of ontology, namely subjectivism and objectivism.
 - The Objectivist holds the view that social entities exist in reality external to social actors. Consider the following example. If a company hired new

managers who had a more “commercially aggressive” culture but the management processes and culture remained unchanged then a researcher would normally take an “objectivist” stance.

- In contrast the Subjectivist holds the view that social phenomena are created from the perceptions and consequent actions of social actors. That is to say, it is about understanding the meanings that individuals attach to social phenomena. Thus it is variable in nature. In context with the previous example, an objectivist would view the culture of an organisation as something that an organisation “has”, whereas a subjectivist would view it as what it is as a result of the social phenomenon.
- Epistemology is the researcher’s view of what constitutes acceptable knowledge in the field of study. Here, there can be three aspects depending on the researcher’s views of what is considered important.
 - Positivism. When the researcher places more importance on facts, data and real objects (objective data), it is said to represent a ‘positivist philosophy. Thus the positivist researcher uses only phenomena that can be observed and measured, would work with existing theory to develop hypotheses, much like a traditional scientist. Hence this veers towards quantitative research although qualitative is also sometimes used.
 - Realism. This is similar to positivism in that it assumes a scientific approach to the development of knowledge. The essence of realism is that the truth is what the senses show as reality. In other words, objects have an existence independent of the human mind. There are two aspects of realism, critical and direct. Direct realism is a one-step approach and says that “what you see is what you get”. Critical realism claims that there are two steps to experience the world, firstly the objects and its sensations and followed by the mental processes afterwards. More importantly for business and management research, there are different approaches. Thus the direct realist operates in an unchanging business context at one level (the individual, group or

organisation). In contrast, the critical realist recognises the importance of multi-level study as each level has the capacity to change the understanding.

- Interpretivism. On the other hand, when the researcher places more importance on feelings and attitudes, that is social phenomena that cannot be directly measured then it is said to represent an interpretivist philosophy. The researcher attempts to understand the differences between humans as social actors and focuses on the situation by employing an empathetic stance. This is more suited to qualitative research with small samples and in-depth investigation.
- Axiology is a branch of philosophy that studies judgements about values. It is about the researcher's view of the role of values in research. For example a researcher may place more importance on data collected through interviews rather than an anonymous questionnaire.

Saunders et al (2009) also discusses pragmatism. The pragmatist holds the viewpoint that the most important consideration is the research question. Therefore if the research question is ambiguous, it is possible to work with variations in the ontology, epistemology and axiology. Thus a pragmatist does not necessarily adopt one position and it can lead to usage of mixed methods (both qualitative and quantitative).

There are two aspects of methodology, namely ontology and epistemology. Ontology is a theory of what exists and how it exists whereas epistemology is about how one comes to know about these things (Clough & Nutbrown 2002). A primary ontological distinction is about the nature of the entities being measured; however these discussions are beyond the realm of research (Oliver 2004). In either case, ontology is closely related with the epistemological basis of the research.

Oliver (2004) describes epistemology as the study of the grounds on which the knowledge is claimed as truth. It can be further used to justify the adoption of certain data collection methods. A positivist epistemology indicates that the truth claimed in the thesis is based on the tenets of natural science and might employ surveys and

quantitative analysis of questionnaire data. On the other hand, an interpretivist or non-positivist epistemology implies the use of methods like unstructured interviews or participant observation.

4.3.3 Research Approach

Most research projects involve the use of theory. The extent to which the theory is used leads to the research approach. (Saunders et al 2009).

There are two approaches, viz. deductive and inductive.

- In the Deductive approach, the researcher develops a theory and the corresponding hypotheses and designs a research strategy to test the hypotheses.
- In the Inductive approach, the researcher collects data and then develops the theory after analysing the data.

Typically, deduction is associated with scientific research, use of a structured methodology and veers towards positivism. Other characteristics of deduction include operationalisation of concepts and generalisation.

On the other hand, induction is associated with alternative theories, use of smaller samples, use of qualitative data, and a more flexible structure and there are fewer generalisations. It is thus typically associated with interpretivism.

4.3.4 Research Strategies

Before Saunders et al (2009) discusses the various research options, he encourages researchers to think about the research purpose. This is classified as exploratory, descriptive and explanatory.

According to Yin (2003) also, the research purpose can be divided into the same three groups, exploratory, descriptive, or explanatory.

- Exploratory research is appropriate when a problem is difficult to structure and when there is a degree of uncertainty regarding what models to use, and what characteristics and relations are important. The purpose is to gather as much information as possible about the subject and the techniques most suited for it are literature search, interviews of experts and focus groups (.Saunders et al 2009)
- The objective of descriptive research is to ascertain and describe the characteristics of the variables of interest (Cavana, Delahaye & Sekaran 2001). It is often used when a problem is well structured and there is no intention to investigate cause/effect relationship (Yin 2003). Saunders et al (2009) argue that this is also used as an extension to exploratory research.
- On the other hand, explanatory research is used to analyse relationships, explaining what cause produces what effects (Yin, 2003). The objective is to develop a theory that could be used to explain the effects with a view to generalising them. This is also known as hypothesis testing (Cavana, Delahaye & Sekaran 2001). It is used to study a situation in order to explain the relationship between variables (Saunders et al 2009).

Saunders et al (2009) then go on to describe the different research strategies. They are

- Experiment. They are mainly used in natural sciences and its purpose is to study causal links. Typically involves definition and testing of hypothesis in a controlled manner using a small number of dependent variables.
- Survey. Usually associated with the deductive approach and is a popular strategy in business research. A sizeable amount of data is gathered using a questionnaire administered to a select sample.
- Case Study. This is used typically in explanatory and exploratory research. It is a deeper study of a particular subject in order to gain an intensive understanding. This method is especially important for getting to the bottom of the context of a problem, generating a much richer picture of the set of issues. There are a

number of general methods that can be used including questionnaires, surveys and documents. As this thesis is a case study, this is discussed in more detail.

- Action Research. This method tends to involve the research subjects in the process of research itself. The object of such activity may be a particular institutional problem, which itself may have important ramifications on an organisation if resolved. The focus is on action, as stated in the title, and on outcomes. This method is often applied to the management of change and is rather inductive in nature, compared with a deductive approach, which expects the detachment of the observer from the observed.
- Grounded Theory. This technique is based on the gradual building up of data into theory. The method begins without an initial theoretical framework (i.e. without a hypothesis), but a theory emerges from the process of aggregation of data and knowledge. Increasing knowledge permits the postulation of ideas that can be tested in turn and any emergent theory remains grounded in the data that have already been collected. In this sense the method is actually a combination of induction and deduction.
- Ethnography. This is a rather specialised inductive approach that is based on time-consuming, firsthand observations of behaviour and is especially suitable to the social sciences. The idea is to observe reactions of individuals (usually) in their own environment and this may apply equally to business as to field anthropology.
- Archival Research. This makes use of administrative records and documents as the principal source of data.

Each strategy can be used for exploratory, descriptive, or explanatory research (Yin 2003).

The above discussion was largely based on Saunders et al (2009). However, a number of other frameworks classify research as qualitative or quantitative. Each approach has its own principles, activities and its own advantages and disadvantages. Very simplistically, quantitative researchers use numbers, normally in the form of

statistics, to explain phenomena. Qualitative researchers, use words to describe trends or patterns in their research.

The approach to be used is dependent on a number of factors, the key ones being the nature of the research question, type of analysis to be done and control over the investigative events. It also depends on availability of time and resources. Typically surveys or questionnaires are used when collecting data for quantitative research, whereas for the qualitative method observations and interviews are used.

This thesis is based primarily on qualitative data, since no calculations are performed. However data from various sources like the ERP system are used as supporting evidence.

Hancock & Algozzine (2006) offer a number of examples to decide between the two approaches.

- If time and resources are limited, a quantitative approach may be more appropriate. This is because it involves instruments like surveys and tests to measure specific variables from large groups of people. These instruments typically produce useful data in short time periods with reasonable investment of resources.

In contrast, a qualitative approach may require individual interviews, focus groups, observations, a review of existing documents, or a number of these. Although these data sources would result in a wealth of rich information, considerable time and resources may be required to adequately represent the area being studied.

- If little is known about an issue, a qualitative approach might be more useful. Whereas a typical quantitative research project identifies and investigates the impact of only a few variables, qualitative research attempts to explore a host of factors that may be influencing a situation.
- If access to people who can participate in the research study is limited, a quantitative approach may be preferred. This is because quantitative research can often be accomplished with minimal involvement of participants. In

contrast, the individual interviews and focus groups inherent in qualitative research may slow one's research efforts if access to individuals is difficult.

- If the consumers of research findings prefer words to numbers, a qualitative approach may be best. However some may be more receptive to findings derived from quantifiable data than to results based on words, feelings, and expressions.
- Another factor affecting decisions to use a qualitative or quantitative approach involves the relationship of the researcher to those being studied. In qualitative research, the goal is to understand the situation under investigation primarily from the participants' and not the researcher's perspective. This is called the emic, or insider's, perspective, as opposed to the etic, or outsider's, perspective.
- Finally, because the researcher is the primary instrument for data collection and analysis in qualitative research, she must spend significant amounts of time in the environment of those being studied. In contrast, a quantitative researcher often seeks to remain blind to the experimental conditions of her research in order to maintain objectivity and to avoid influencing the variables under investigation.

Clearly, qualitative and quantitative approaches to research differ in a number of ways, each with its own unique features. Neither approach is right or wrong, although one approach may be more appropriate than the other depending on the nature of the research question and predisposition of the researcher. In some cases, researchers implement activities of both approaches in the same research study

Although the general characteristics of qualitative research are the same, differences exist between specific types of qualitative research. Hancock & Algozzine (2006) describe five major types of qualitative research (paying special attention to case studies). They are

- Phenomenological studies which explore the meaning of several people's lived experiences around a specific issue or phenomenon.

- Ethnographic studies which investigate cultural or social groups to find and describe beliefs, values, and attitudes that structure the behaviour, language, and interactions of the group.
- Grounded-theory qualitative research where the researcher seeks to create a theory that explains some action, interaction, or process.
- Biographical studies which include life and oral histories and classical and interpretive biographies, constitute another type of qualitative research in which a researcher explores a single individual and her or his experiences.
- Case studies represent another type of qualitative research. They are different from other types in that they are intensive analysis and description of a single unit like individuals, events, or groups. Through case studies, researchers hope to gain in-depth understanding of situations and meaning for those involved.

The qualitative approach was found to be more suitable for the purpose of this thesis, as the purpose is to gain a better understanding of how the various influencing factors can be used to reduce procurement costs.

According to Yin (2003), there are five primary research strategies in the field of social science research: experiments, surveys, archival analysis, histories, and case studies. Each strategy has its own advantages and disadvantages depending on three conditions:

- The type of research question posed.
- The extent of control an investigator has over actual behavioural events.
- The degree of focus on contemporary, as opposed to historical events.

Yin (2003) said that the case study is the preferred approach when “how” or “why” questions are being posed, when the investigator does not have much control over the events and when the focus is on a contemporary phenomenon within a real-life context. The case study is an ideal methodology when an in-depth investigation is needed. It has been used in many investigations. When using the case study approach the researcher systematically gathers in-depth information on a single entity using a variety of data gathering methods (Cavana, Delahaye & Sekaran 2001).

Case selection often has to be opportunistic (Seuring 2005). And whilst a multiple case study approach may be more appropriate, it might be difficult to find suitable examples. Therefore it is best to start from a focal company. Case study research in supply chain management can help to further explore the field, but is also valid for theory building, testing and extension.

Yin (2003) has had extensive experience in this approach and has developed well established steps in conducting a case study research. He recommends that a case study has four stages:

1. Design of the case study,
2. Conducting the case study,
3. Analysing the case study evidence, and
4. Developing the conclusions, recommendations and implications.

According to Tellis (1997), a frequent criticism of the case study methodology is that it does not provide a generalised conclusion as it is based on a single case. However Yin (1997) refutes this view. He argues that the relative size of the sample does not transform a multiple case into a macroscopic study even when 2, 10, or 100 cases are used. The goal of the study should establish the parameters, and then should be applied to all research. In this way, even a single case could be considered acceptable, provided it meets the established objective.

Yin (2003) identified five components of research design that are important for case studies:

- A study's questions
- Its propositions, if any
- Its unit(s) of analysis
- The logic linking the data to the propositions
- The criteria for interpreting the findings.

Finally, it must be argued that the case study methodology is particularly relevant for research into supply chains because it can help gather better information about the

realities of supply chains and develop better, more complete theories about them (Koulikoff-Souviron & Harrison 2005)

4.3.5 Research Choices

Drawing on Saunders et al (2009) research onion, the next logical stage in the research process is the research choice. He defines it as the way the researcher chooses to combine qualitative and quantitative data. Other authors use the term research design.

There are three choices available; mono, mixed and multi methods.

- Mono Method. When a single data collection technique is used with a single data analysis procedure, then this is referred to as the mono method. E.g. use of questionnaires (quantitative) with quantitative data analysis procedures.
- Multi-method. This refers to use of more than one data collection technique with the associated analysis technique. This can lead to multi-method quantitative study or a multi-method qualitative study.
- Mixed Method. This is when both quantitative and qualitative data collection techniques and analysis procedures are used in a research design.

4.3.6 Time horizon

There are two different types of time horizons, cross-sectional and longitudinal studies. (Saunders et al., 2007).

- Cross-sectional studies means that the research is based on a particular phenomenon at a particular time, and it can also be called a “snapshot” approach.
- Longitudinal studies differ by looking at development over a certain time period. This method tends to follow a problem right through from inception to resolution. In this sense it is especially suitable for use on problems that are developing over time, or for studying subjects over extended periods in order to assess change in real time. It is typically associated with longer-term research projects.

Since this thesis is studying the procurement processes at a particular time period, it is evident that it is cross-sectional.

4.3.7 Data Collection

In keeping with the research onion, the last layer to be peeled is the data collection methods. Saunders et al (2009) propose a number of aspects that must be considered. They are

- **Primary Data.** Primary data is new data that is specifically collected for the research. This data can be collected in several ways, for instance through observations or by interviews. The primary data sources in this research include data gathered from ERP systems, interviews conducted with staff and personal observation of the purchasing processes.
- **Sampling.** Sampling allows the researcher to narrow down on a representative selection of data to optimise effort. Two techniques are available, Probability or representative sampling and Non-Probability or judgemental sampling. Probability sampling is based on a sampling frame that restricts the data and yet is representative of the population. When it is not possible to collect such a sampling frame, then the use of non-probability sampling is recommended.
- **Secondary Data.** This is data that has already been collected by other people in other researches. It includes both quantitative and qualitative data. Secondary data can be divided into three main groups; documentary data, survey-based data and data compiled from multiple sources. There are many advantages of using secondary data. Primarily it saves time and is less expensive as the data has already been collected. In addition, it is likely to be of higher-quality than the data that is collected by the researcher. Secondary data can be used in comparison with the primary data (Saunders, Lewis and Thornhill 2009).
- **Observation.** When collecting data for a research, the role of the observer is an important aspect that influences the design. The role of the observer may be participant or structured. Participant observation is where the researcher participates in the activities of those whom they are studying. Structured

observation is associated with quantitative research and is concerned with the frequency of events.

- Other Primary Data Collection techniques. Interviews and Questionnaires are frequently used to collect information.

4.4 Ethical Issues

In this context, ethics is about the appropriateness of this research in the organisation and the researcher's behaviour and attitude.

According to Oliver (2004), the following points must be noted when conducting the research.

- The researcher must ensure that the participating organisation and participants are treated with care, sensitivity and respect.
- The principles of informed consent must be strictly adhered to. The participants must be kept informed at key stages during the research duration about the progress.
- It may also be necessary to ensure anonymity of the participants.
- Interview ethics is an important aspect and must be kept in mind during the interview.

As part of this research, the following steps were taken into consideration in order to uphold the research ethics.

- The initial research proposal was discussed with the Head of Infrastructure Supply Chain and the Supply Chain Excellence Manager. Various aspects of the research were discussed before the topic was finalised.
- A confidentiality undertaking was signed with Telecom to ensure that the usage of the company information for academic purposes only. A copy of this is attached in Appendix B.
- In order to preserve confidentiality, some key figures have been masked. Names have been coded where possible.

4.5 Choice of Methodology

As discussed, there are a number of aspects of research design. Choices had to be made on these aspects. A discussion of the choices follows based on the “research onion”. Table 4.1 lists the various layers that are considered.

Table 4.1: The Research Onion Layers

	Layer	Approaches
1	Philosophy	Positivism, Interpretivism, Realism, Pragmatism
2	Approach	Deductive, Inductive
3	Strategy	Experiment, Survey, Case study, Action research, Grounded theory, Ethnography, Archival research
4	Choice	Mono, mixed or multi methods
5	Time horizons	Cross Sectional, Longitudinal
6	Data collection	Sampling, Secondary data, Observation, Interviews, Questionnaires

Source: Saunders, Lewis and Thornhill (2009), page 108

- Philosophy. From an epistemological perspective, this research is realist rather than positivist or interpretivist. Positivism tends to be associated with the use of quantitative data whereas interpretivism is generally associated with a changing world that has changing perspectives depending on the respondents and the interactions with them. (Oliver 2004).
- Approach. This research is based on the Deductive approach as the researcher has developed a theory of the areas that influence procurement costs and efficiencies. Data has then been collected to confirm or refute the theory.

- Strategy and Research Type. This research attempts to understand the procurement practices at Telecom with a view to identifying the key factors that impact costs. Thus the research process is very exploratory in nature and uses data from a number of sources in the analysis.

By applying the reasoning described in Section 4.3.4, it appears that the case study is most fitting strategy for this research. In addition, the case study approach was adopted for this research because of the following reasons

- The study is being conducted on a single organisation. Focussing on a single organisation meant that more time could be invested in actually doing the research
 - It enables the researcher to gain an in-depth understanding of a situation before applying the principles of supply chain management
 - It is useful for examining the “how” and “why” questions so that new insights and knowledge may be gained (Yin, 2003)
 - Even though it is based on a single organisation, points of view from a number of people across a cross-section of departments are used.
- Choices. Data has been collected from a number of sources, some of which are qualitative and some of which are quantitative. Hence it can be said that the mixed-mode choice is used.
 - Time Horizons. This research is based on observations at Telecom NZ during a particular time. Much of the data used is a “snapshot” taken at a particular time. Thus the time horizon can be classified as “cross-sectional”.
 - Techniques and Procedures. This case study is based on the researcher’s discussions with a number of people in the organisation, the data obtained from the ERP system and current leading practices in the supply chain field.
- The primary data sources in this research include data gathered from ERP systems, interviews conducted with staff and personal observation of the purchasing processes.
 - The secondary data collected for this research includes information from Telecom’s websites, the purchasing policies and procedures and other written

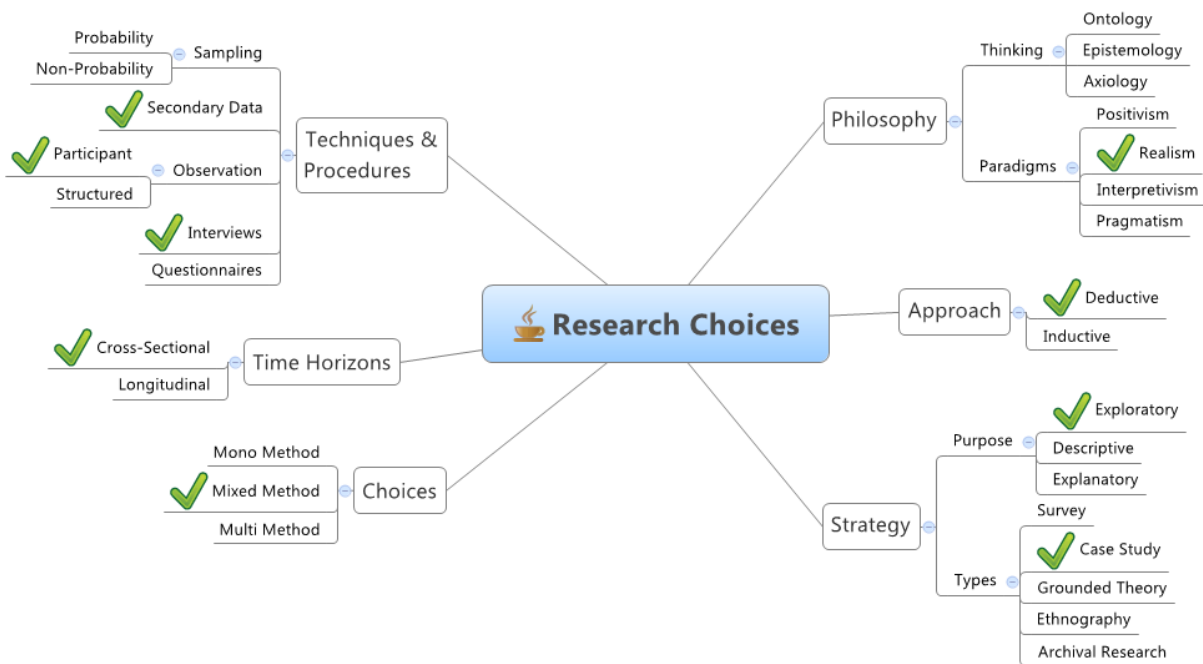
materials. It also includes comprehensive research on the subject using books, journal and Internet resources.

- The author was actively involved in many projects at Telecom New Zealand during the course of this study and hence the technique used was participant observation. During the time, a number of persons were also interviewed.

4.5.1 Summary

Figure 4.2 depicts the available aspects of the research design based on Saunders et al (2009) definitions and the choices that have been made.

Figure 4.2: Research Choices



Chapter 5. Analysis and Discussion

5.1 Introduction

The findings of the research are presented in this chapter with suitable analysis and discussion. This chapter is structured as follows:

- Section 5.2 has a description of the organisation and current state of the procurement processes accompanied by a discussion on the findings and recommendations. The scope is company-wide. This section is based on the work done during an e-procurement review by the author during 2009-2010.
- Sections 5.3 and 5.4 are about Category Management and Spend Analysis. These sections are based on the work done by the author whilst implementing a company-wide category management and spend analytics system in SAP during 2009-2010. The data used is based on procurement spend between July 2008 and March 2010.
- Section 5.5 discusses supplier management followed by an analysis of supplier performance metrics.
- Section 5.6 analyses on how Information Technology can be used to achieve efficiencies in the procurement process. There is a special focus on e-procurement as it is based on a company-wide e-procurement review by the author during 2009-2010.
- Section 5.7 concludes this chapter with an analysis of the “fixed networks” supply chain using the SCOR model. Some relevant metrics are presented.

5.2 Purchasing and Supply Management

5.2.1 Purchasing Organisation in Telecom

The purchasing organisation at Telecom is part of the T&SS (Technology & Shared Services) business unit and is a shared function across the whole of Telecom.

It is led by a Group Purchasing Officer (GPO) who reports to the General Manager T&SS. Various Heads including Technology Sourcing, Corporate Sourcing, Category Management and Supplier Relationship report to the GPO. There are also administration personnel. The key functions of this team are

- Supplier management
- Strategic sourcing including supplier selection
- Contract negotiation and management
- Supplier performance evaluation
- Category Management

Purchase order processing, invoice processing and handling of other AP (Accounts Payable) transactions are not performed in this team. It is managed by the Shared Procurement Services team with whom there is an arms-length relationship.

Until the advent of the GPO in 2009, the procurement organisation structure was decentralised. However, since then a centralised function integrating a vision and strategy has been established and now has almost 40 staff members. The new organisation was being constructed during the course of the research and it is likely that the comments made in this section may not relate to the current state. The new structure now has category managers and sourcing managers that deal with the commodities purchased. It is understood that their task is to elevate tactical procurement to a strategic level. Their focus is to assess opportunities for Telecom across one or more categories. Category Managers also have strong links with the various business units. It also has supplier relationship and contract managers, who manage relationships with key vendors.

Procurement personnel exist across T&SS (Transformation and Shared Services), Retail, AAPT, Gen-i, AAPT, and Chorus. Similarly logistics functions are also decentralised. There is a separate S&OP (Sales and Operations Planning) team; however there is minimal integration with procurement. The purchasing processes across each business unit is different and there is very little information sharing. Whilst T&SS is supposedly a central sourcing team, their involvement has been

restricted to only large significant projects. A number of sourcing decisions are made within each business unit.

Across all business units, there is about 60 staff involved in sourcing and vendor management activities. In addition there is about 85 staff associated with other aspects of procurement like creating purchase orders, invoice handling etc.

The current procurement team deals mainly with strategic matters and not operational. The team is responsible for policy, process systems and tools. Inventory management does not come under their purview. Decisions about inventory forecasting, optimum inventory levels are the responsibility of business unit. The same applies for decisions regarding EOQ (Economic Order Quantity), lot size, order size etc.

5.2.2 Process and Systems Overview

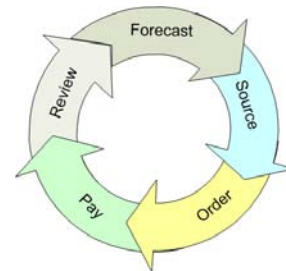
Telecom's purchasing process is a mix of sourcing, purchase order based procurement and direct accounts payable processes. Purchasing is initiated in the SAP R/3 system for material and service orders and in SRM for catalogue based purchasing. Invoices are currently processed through a mix of processes including electronic integration, scanning / OCR and manual entry.

Telecom's supply network is comprised of a number of entities as described below.

- Suppliers of Products. These include organisations like Nokia, Marconi, Juniper and Alcatel-Lucent.
- Suppliers of Service. These include service companies like Downer, Visionstream and Transfield, repair agents like RGL, Information Services providers like EDS, Sun, Marketing and Advertising Services like Saatchi & Saatchi etc.
- Logistics Suppliers. These include suppliers for warehousing and transport services etc.
- Other. In addition there are a number of other suppliers for office supplies, travel, accommodation, temporary staff etc.

As described in section 3.4.3, the procurement cycle can be broken down into the following process areas.

- Forecast
- Source
- Purchase
- Pay
- Review



Each of these processes is described in more detail below. The current procedure is described, followed by use of information technology for the process area. Recommendations are then made to improve process efficiency.

5.2.3 Forecast

The goal of a typical forecasting process is to identify requirements and plan procurement optimally. This section describes the current state of the forecasting process at Telecom. Gaps, if any are also identified.

There is little evidence of a proper procurement forecasting process at Telecom. A formal S&OP team does exist, however there is no direct relationship to purchasing. The current activities that could be said to be connected to forecasting are:

- For large capital projects, an investment plan is initiated by the Investment Manager who prepares a report detailing the goods or services to be purchased and a cost estimate and submitted for approval. The report is at a very high level and may only have some indicative volumes or SKU numbers. There is not enough detail to be used as a forecast for downstream activities.
- Network spares are managed by SKU number and a MRP (Material Requirements Planning) run is executed in the SAP R/3 system for planning the replenishment. The forecast is based on past consumption and repair/purchase lead times.

- For broadband expansion cards, a joint forecast is prepared with the supplier based on current usage and some demand forecasting. Purchase Orders are manually created based on the forecast.
- For the Gen-I business unit, the sales forecast is sometimes used to prepare a purchase forecast.
- Information technology usage in this area is limited to MRP for network spares.

Overall, there is minimal visibility of marketing initiatives that can be translated to procurement actions. Demand forecasts are not matched up with actual supply and capability availability.

The following are likely downstream issues in the absence of a forecast.

- For direct materials and services, a lack of forecast leads to high inventories and high cost. An example of the resulting impact can be seen in the fixed network hardware.
 - The supplier cannot use sea freight as sufficient lead times have not been provided. Hence they are air-freighted leading to high logistics costs as well as high inventories.
 - Another side-effect of air-freighting is that it leads to a high number of in-transit damages as goods are offloaded to various airports.
- Freight, storage and downstream service costs cannot be planned or optimised.
- Chances of obsolescence especially in the high-tech industry are increased due to poor inventory planning.
- Cannot compare actual with forecast performance

5.2.4 Source

This section describes the current state of the sourcing process at Telecom. Gaps, if any are also identified.

Not all purchases go through a sourcing process. The central T&SS procurement team is involved only for some large project related purchases, whereas the Retail, Chorus and Gen-I business units typically manage their own sourcing. A formal process does not exist for other purchases especially for services.

Where a formal sourcing process is carried out, the following procedures are generally followed. There are small variations in each business unit.

- **Requirements.** The process involves discussing the business needs, engaging the key stakeholders and understanding the strategy to be used. In some instances, a formal business case document is prepared. Requirements are not always clear or may not be known at the time of the activity. In many instances, the solution has already been selected before even the requirements are finalised. The supplier may already have been identified and all that is required of procurement personnel is a contract.
- **Market Analysis.** Market research and analysis is performed purely on an adhoc basis.
- **Supplier Selection.** For large project related purchases, a more formal process is followed and tenders, RFI (Request for Information) or RFP (Request for Proposal) documents are issued. The T&SS department is involved only during commercial discussions and price negotiations, other technical aspects are managed by the requestor. The selected supplier(s) are then short-listed for the next stage.

There is a massive variance in client engagement, documentation, quantity and quality of proposals. Also sometimes the business pushes for a certain supplier and is not keen to consider other options.

- **Contract Negotiation.** A draft contract is prepared and terms are negotiated with the supplier. For new contracts or renewals with existing supplier, spend data is used if available. A formal contract is then signed and the paper copy is stored. In some instances it is entered in a contract system, not SAP. It appears that contract terms are not consistent across business units or purchases. Lack of contract

visibility leads to maverick purchasing, usage of other than preferred suppliers and inability to avail of volume discounts.

- Supplier Setup. Once a supplier is selected and the contract is signed, the necessary system data must be setup. For new suppliers, important information like name, GST#, address, payment terms etc. are captured as supplier master data in the SAP system. For purchases planned in SAP SRM, catalog information is setup. The usage of electronic communication like EDI, CATI is decided based on the expected volumes.

From an information technology perspective, the following was observed

- Supplier catalogues are created in SAP SRM for about 30 vendors. Whilst these purchases account for only 2% of the total spend, they constitute a high volume of purchase transactions. They are currently used for
 - Direct. Frequently used network items like broadband, modems, routers, network cards, mobile phones etc.
 - MRO. Network Spares.
 - Indirect. Stationery, office and kitchen supplies
- Many organisations that have ERP systems use material codes to manage frequently used items. This number uniquely identifies an item and is used throughout its lifecycle right from planning through to inventory management and finally disposal. At Telecom, most of the purchases (with the exception of Gen-i) do not have a SKU or material number.
- In some instances where a material code is used (mostly IS hardware and network spares items), the contracted price is updated in SAP purchase info records. Whenever a purchase order is created the system automatically populates the agreed price and lead times.
- Contracts and Agreements are created but they are not stored in the main SAP ERP system. Instead, each business units keep it in separate locations and it is not

linked to the SAP ERP system. As a result there is no visibility of contracts and agreed prices when creating a PO.

5.2.5 Purchase

This section describes the current state of the purchasing process at Telecom. Gaps, if any are also identified.

Most of the purchases at Telecom require a purchase order, with the exception of some suppliers that are exempt. Many variations exist, depending on the origin of the purchase document and the business unit. The key process steps are described below.

- Requesting for a purchase. A typical purchase process starts with a purchase requisition. (See Figure 3.10). However at Telecom, it is used only for a small subset of the purchases.
 - Purchasing policies are defined in the intranet and there is a list of preferred suppliers for frequently purchased items. However this list is very small and covers only a small percentage of purchases.
 - When used, staff request for regular purchases by using a centralised form on the company intranet. They are required to enter valid information for GL code, cost centre, material groups, supplier number etc. This information is re-keyed into SAP and results in creation of a PO. The creation of a PO in SAP is restricted to a few authorised buyers in the various business units.
 - Staff can order some purchases directly from the SAP SRM system by shopping from a catalog. This is restricted to only the available items described in the previous section.
 - Requisitions for network spares are generated automatically using SAP MRP (Materials Requirements Planning). These requisitions have all the required information from the master data (supplier no, price, delivery date etc.) and are then converted to a PO.
 - For the Gen-i third party sales in SAP R/3, purchase requisitions are automatically created based on master data.

- For services like network repairs, creation of trouble-tickets in SAP automatically results in purchase requisitions for repair on the authorised repair agent. As with the others, these require prior setup of material codes and master data.
- Purchase Order creation. PO's can be also created in the SAP system without a requisition.
 - As contracts are not held in the SAP system, there is no check to prevent a PO being raised on a supplier when a different preferred supplier exists.
 - Minimal or inaccurate information is available during PO creation. This impacts follow-on activities. E.g. the correct delivery date is not entered which leads to inaccurate supplier delivery performance or accrual posting.
 - Sometimes credit cards are used to bypass the normal procurement process. As a result it is difficult to get reports on contract adherence, compliance to procurement policy or maverick spend.
- Approval of purchase. Purchase requests in SAP are subject to approval depending on the item and the DFA (Delegated Financial Authority). Approvers are notified using workflow.
 - In reality, the approvers do not often query requirements for purchase.
 - There is also visibility of the status of the approval. It can be a slow time-consuming process as approvers can be on leave and the approval request just sits in the system.
- Purchase Order release. When the request is approved, the Purchase Order is released. The PO document (in pdf format) is then automatically sent to the requestor who manually forwards it on to the supplier. Where electronic communication is setup with a supplier, the PO is transmitted electronically.
- Order Acknowledgement. In a few cases, the supplier electronically confirms the receipt of the PO. Any changes must be manually processed.

- Goods Despatch. Goods are sent to various locations depending on the terms and type of purchase. Electronic Advanced Shipping Notification (ASN) has been implemented for one supplier.
 - Large network items (mainly infrastructure purchases) are sent directly to the service contactor's site. Other network items like spares and smaller cards are sent to the central warehouse in Auckland.
 - Purchases in the Gen-I business unit are sent to the company's warehouse or to the customer directly.
 - Corporate items are sent to the requesting location.
- Goods Receipt. Most purchase orders require a goods receipt. Typically the requestor notifies the buyer when the goods/ services are received so that the PO can be updated with the Goods receipt status. In the SAP system, this is an important step which updates inventory, forms the basis of supplier delivery performance, and creates financial postings. Invoices cannot be paid against a PO, if this is not done. It was observed that in many instances the requestor forgets to perform the GR or notify the Accounts Payable team when the goods/services are received, resulting in downstream issues.

5.2.6 Pay

This step occurs for every purchase and is triggered by the receipt of the invoice. This section describes the current state and identifies any gaps.

The activities in this area are:

- Entering an invoice. There are a number of ways this occurs.
 - Most invoices are received by the Central AP team. They are scanned using the Readsoft invoice scanning software or manually entered.
 - Electronic Communication. A few vendors (with significant volumes) send their invoices using EDI or the telecom provided CATI tool. This automatically creates a vendor invoice in the system.

- Manually Uploaded. Some vendors email a spreadsheet containing the invoice data to the AP team. This is then manually uploaded into the SAP system. A PO is not required for this.
- ERS. In the ERS (Evaluated Receipt Settlement) process, the goods receipt on the PO triggers the creation of the invoice thus removing the need to receive and process a supplier invoice. This is also called buyer created invoice and is currently used for about 75 suppliers.
- Recurring Payments. Some regularly occurring jobs are paid automatically based on an agreed contract with the supplier. There is no PO required. This arrangement exists with over 53 suppliers.
- Invoice Verification. There are two levels at which this occurs.
 - If an invoice is related to a PO, the SAP system requires a three-way match. This functionality is called LIV (Logistics Invoice Processing). This means that the PO, Goods Receipt and Invoice must all line up in terms of quantity and amount (within a certain tolerance). If the corresponding PO cannot be found, the invoice cannot be posted and it is “parked” and kept aside. If the PO is found and the quantity or price does not match or if it is not goods received, the invoice is “blocked”.
 - If an invoice does not require a goods receipt, a two way match is done. I.e. the PO and invoice is matched.
- Invoice Payment. Payment to supplier occurs through electronic transfer at regular intervals based on the agreed payment terms. In rare instances cheques are prepared.

A number of issues exist in this area as described below:

- Based on anecdotal evidence, it appears that a large number of invoices are not processed on time. This may be because they may not have been received at the correct location.

- There are too many non-PO invoices. Typically this should only occur for government purchases and other contributions towards insurance, ACC, IRD etc. It was found that a number of non-government vendors are exempt from requiring a PO and this requires further investigation.
- Only 30-40% invoices scan directly into the Readsoft scanning system without any manual intervention and a large amount of time is spent in manually fixing scanning issues. There are a number of reasons for this including varying invoice formats, handwritten invoices, poor image quality etc. In many instances, the required information is not there and communication must be established with the supplier or buyer to obtain the required data.
- A large number of invoices are parked or blocked (about 25% to 30%) and additional workload is required to resolve these issues.
 - The main cause of parked invoices is the absence of a PO. It was observed that in over 60% of the parked invoices, PO's are raised only after the supplier has completed the work and the invoice is received.
 - The main cause of blocked invoices is the mismatch of quantity and price or the PO has not been goods receipted. This is because suppliers do not get a paper copy of the PO so they are unable to submit an invoice with the correct references, quantity and amount.

5.2.7 Review

This is the last and an important stage of a purchase. It is performed in varying degrees at Telecom and most often not done at all.

- Supplier Performance. There is no formal procedure for evaluating a supplier when a purchase is complete. Reviewing supplier performance is done purely on an adhoc basis for key suppliers. In these cases also, the process is purely subjective and no formal metrics are calculated.
- Contract Evaluation. As above, this is done for some large contracts but there is no formal process and is subjective.

- Spend Analysis. This is performed on an adhoc manner based on data from various sources. It tends to be very subjective.

Analysis shows that

- There is no single repository for contract information, supplier information or spend information that can provide information to conduct a successful review.
- Very little management information is produced on a regular basis either at a pan-Telecom or at a business unit level. This makes it impossible for one part of the business to know what another part has purchased, and could lead to a duplication of spend.
- Similarly there is no documented process for peer reviews, PO closure, reporting quality issues and defects (e.g. a number of out of box failures exist for goods in the service companies, but they do not know what to do and hence consume spares).
- Purchase Orders for large projects are entered to suit payments but the details of the items purchased are not recorded. E.g. a number of network hardware and service items may be purchased for a large project. Whilst the details of the items being purchased is available on a paper copy of the contract document, the purchase orders are created as per the milestone payment schedule and have no details in it bar a brief description saying “Payment No N for contract XYZ”. The lack of any information including “material groups” makes it very difficult to report on spend by category or supplier analysis.
- Until recently there was no formal analysis of purchasing spend by categories. Whilst there is a spend report, it is subject to errors as the base data is incorrect and needs extensive cleansing before it can be used to make any reliable decisions. There are a number of reasons for this the key ones being a lack of purchase process standardisation and incorrect data for categorisation. However, this has been taken up recently and is described in the next section.

5.2.8 Purchasing Process Maturity

Based on the characteristics described by Cousins et al (2008) in section 3.5.2, the procurement function at Telecom New Zealand is very close to Stage 2, the Independent stage. It falls short of Stage 2 in spite of considerable progress having been made on cost measures and establishment of links within the organisation and with suppliers. The reasons are

- Lack of integration with S&OP for forecasting.
- Ensuring process compliance.
- Lack of clear procurement performance metrics.

5.2.9 Recommendations for improving process efficiencies

The sections above highlighted a number of gaps in the purchasing process. Addressing these gaps would create opportunities to improve efficiencies and reduce costs.

- Different types of purchases require different processes. There is no “one size fits all”. To achieve maximum efficiencies in the purchasing process, the right process must be used. There is a need to review the purchase processes and document clearly the process to be used for each type.
- As suggested by Van Weele (2010), not all steps in the purchasing process applies to all scenarios. The process should be tailored depending on the type of purchase as follows
 - **New Purchase.** This is for a completely new product from a new supplier. This has a high degree of uncertainty and requires all the process steps to be diligently used. It also requires extensive setup and monitoring until it is stabilised.
 - **Modified Re-buy.** This is when the organisation wants to buy either a new product from an existing supplier or an existing product from a new supplier. This situation has more certainty and the focus should be on contract

negotiations and ensuring the purchase, pay and review processes work as desired.

- **Straight Re-buy.** This is the most common situation and entails the purchase of a known product from a known supplier. Apart from re-negotiations, this is when known issues are ironed out and agreed with the supplier. The focus should be on improving efficiencies and opportunities for e-procurement.
- A number of issues can be traced back to lack of process compliance. Hence compliance must be carefully monitored and reported on.

Based on the shortcomings identified in each process area, the following recommendations are made.

Forecast

- Implement a formal Sales & Operations Planning (S&OP) process that links the forecast to procurement of goods, especially for direct goods and services. This process must result in a volume forecast for effective usage.
- Where possible bulk transportation could be planned by ship. Not only would this reduce damages but would help reduce inventory and logistics costs.

Source

- A number of projects are underway to address the gaps and to achieve efficiencies.
- The current sourcing procedure is lengthy, not well-documented and not coordinated across business units. Thus there is a requirement to standardize procurement processes across the company. A formal sourcing process that spans requirements gathering, supplier selection and contract management must be implemented. It would increase ability to consolidate vendors and create economies of scale across categories and suppliers.
- Pushing more purchases through the SRM system would improve adherence to preferred suppliers and ensure contracted prices are used. However not all purchases can be managed this way. See section 5.4.3 for more details.

- Contract functionality is available in SAP and was previously used by Telecom. This could be re-instated to regulate usage of preferred suppliers, materials ordered and the cost.

Purchase

- Ensure that the ordering process for each category is correct, efficient, documented and communicated clearly.
- Try and use material numbers for items that will be repeatedly purchased. In order to do that, specifications of frequently used items must be standardised to reduce the number of stock items.
- Ensure that the suppliers receive a copy of the PO and the master data is kept updated.
- Ensure that the delivery dates on PO reflects realistic timeframes.

Pay

- Review the blocked / parked invoices by supplier and narrow down on the reasons for the issues. Address these issues with the requestors and suppliers. This will reduce the time required by the AP team to manually resolve issues.
- The following measures can be taken to ensure process compliance:
 - Communicate with suppliers the importance of delivering goods or services with an authorised PO.
 - Communicating the importance of correct PO referencing, better print quality for invoices with suppliers so that invoice scanning errors are reduced.
 - Reducing the number of non-PO invoices
 - Consider using SRM catalog and contracts to ensure correct pricing and categorisation of purchase.
 - Suppliers should be educated to honour agreed purchase price. Variations should be managed by amending the PO well before the work is completed and not managed as an invoice variance.

- Extend use of ERS to more suppliers. As the goods receipt will automatically trigger invoice creation, there will be no need to enter, verify and match invoices. This will lead to increased efficiencies and reduced purchase processing costs.
- By default, the SAP process requires a goods receipt for all PO's. In some instances this could be turned off so that two way matching could be used thus reducing the time required for resolution. This should be used with care only for relevant scenarios. An example is simple regularly performed services for facilities management like cleaning where there is no point in entering a goods receipt.
- Currently upload invoices are used only for Non-PO purchases. These can be extended to cover PO purchases also. This will mean development of a new (standard) format that includes appropriate PO reference data.

Review

- The current SAP R/3 and SRM systems provide extensive functionality for supplier evaluation. As the base transactions are in the system, this is the most logical place to capture the information.
- The process for purchases related large projects must be sorted out.
- Proper process for completion of PO and closure of large projects.

It must be noted that with the procurement team restructure at Telecom and the subsequent appoint of a GPO, many of these issues have been taken up and various streams of work are in progress to address these issues.

5.3 Implementing Category Management and Spend Analysis

5.3.1 Approach

The purpose of the spend analysis project was to group purchasing spend into categories relevant for the procurement team. However this data was not available.

Initially a one-off exercise was performed to gather data and perform the reporting. Information from the SAP purchasing system was extracted for the analysis. Subsequently it was decided to use a more formal approach to enable this information to be obtained regularly.

5.3.2 Spend Analysis System Design

The following activities were undertaken in order to develop a robust design for spend reporting:

- The first step was to design a category architecture and determine the list of spend categories.
- The next step was to extract spend data from the SAP system and group them into the spend categories. This data is stored in a spend “cube”, a repository in the SAP Business Intelligence system.
- Finally the spend reports were developed from the data in the spend cube.
- In order to ensure that the right category information could be extracted from future purchase orders, suppliers were associated with one or more categories. This data is now used to validate the information entered on the PO.

These steps are described in detail below.

- **Determine spend categories.** The design of the spend categories was an important activity. It needed to be relevant to Telecom and also at a level that is easy to manage.

A category is defined as “A group of products or services that share common characteristics and supply base and is managed by an over-arching strategy. (E.g. Hardware, Recruitment, Business consulting). A category strategy is to be developed for each category. This is a medium to long term plan for how Telecom manages that group of goods and services, based on rigorous analysis and team work. It is a business strategy, a common understanding across all stakeholders, approved by all interested parties

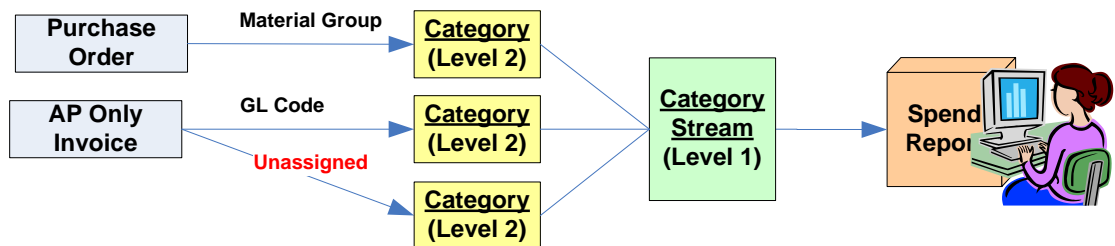
There were no category managers during the initial period, however the present organisation structure is designed around these categories and category managers are now in place. Categories were designed at two levels

- Level 1 - Category Stream. This is a convenient way of grouping related categories for executive reporting. High level strategies and plans are developed at this level.
- Level 2 - Category. A category is a group of products or services that share common characteristics and supply base, and is managed by a pan-Telecom strategy (e.g. mobile hardware, recruitment, network consulting). This is at a level necessary for routine management.

The final list of categories is shown in Appendix A.

- **Classify purchases.** The next step was to categorise the purchases. This was done by using the AP (Accounts Payable) invoice data and assigning a category to each invoice before loading it into a “spend cube”. Most AP invoices have an associated Purchase Order (PO). However some do not. Figure 5.1 depicts the process.

Figure 5.1: Categorising Purchases



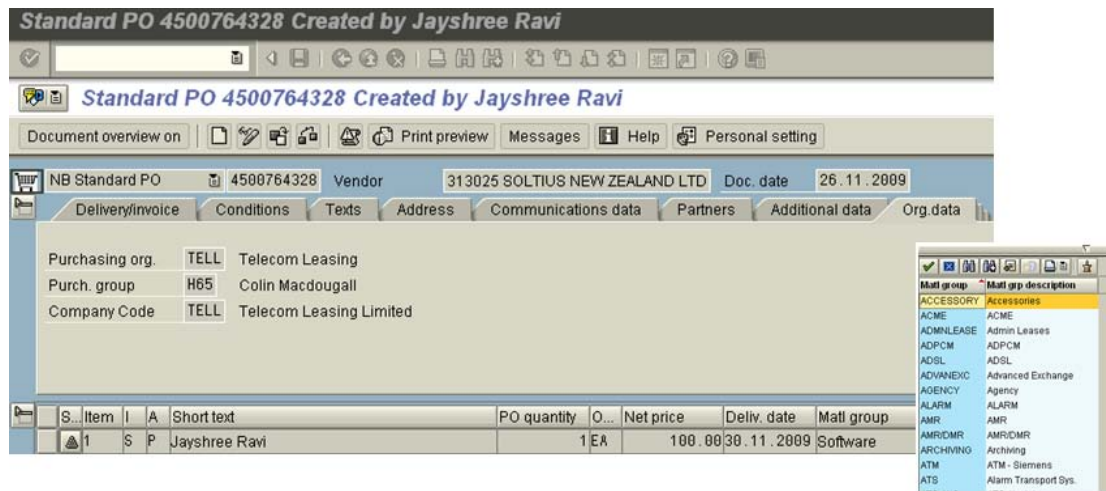
The logic for arriving at a category depends on the presence or absence of an associated PO.

1. Where there is an associated PO, the material group was used to arrive at a category. The material group is pre-defined in a SAP installation and is an important field on a PO. It describes a group of products and is a mandatory entry on the PO. Examples of material groups are catering,

cleaning, PABX, modems, air travel etc. There are about 450 material groups. As part of this exercise, all material groups were reviewed, rationalised and mapped to the categories. Every material group maps to only one category level 2.

An example of the material group in a PO is shown in Figure 5.2:

Figure 5.2: Material Group in SAP



Source: Telecom NZ SAP system

2. If there is no associated PO, the GL (General Ledger) code on the AP invoice is used to arrive at a spend category. GL codes are pre-defined in an SAP installation and are a required data element on every invoice. See Figure 5.3 and Figure 5.4 for examples.

Figure 5.3: Invoice Overview

Itm	PK	Account	Account short text	Tx	Amount	Curr.	Amt. in loc. cur.	Curr.	Text
Doc.type : RE (Invoice receipt) Normal document									
Doc. number		554338	Company code	TNZL	Fiscal year	2011			
Doc. date		18.11.2009	Posting date	01.12.2009	Period	06			
Ref.doc.		006/LB-UTILITIES							
Doc.currency		NZD							
1	31	316868	MUSEUM APARTMENTS	I0	100.56-	NZD	100.56-	NZD	
2	86	945300	GR/IR Control A/c.	I0	100.56	NZD	100.56	NZD	

Source: Telecom NZ SAP system

Figure 5.4: Invoice with GL Code

Vendor:	316868	MUSEUM APARTMENTS	G/L acc	945102
Company code	TNZL	90 CABLE STREET		
Telecom New Zealand Ltd		WELLINGTON	Doc. no.	554338
Line Item 1 / Invoice / 31				
Amount	100.56	NZD		
Tax code	I0			
Additional details				
Bus. area				
Disc. base	100.56	NZD	Disc. amount	0.00 NZD
Payt terms	20MT		Days/percent	32 0.000 % 0 0.000 % 0
Bline date	18.11.2009		Fixed	
Pmnt block			Invoice ref.	/ / 0
Pmnt method				
Clearing	18.12.2009 / 1013469			
Assignment	20091201			
Text				Long text

Source: Telecom NZ SAP system

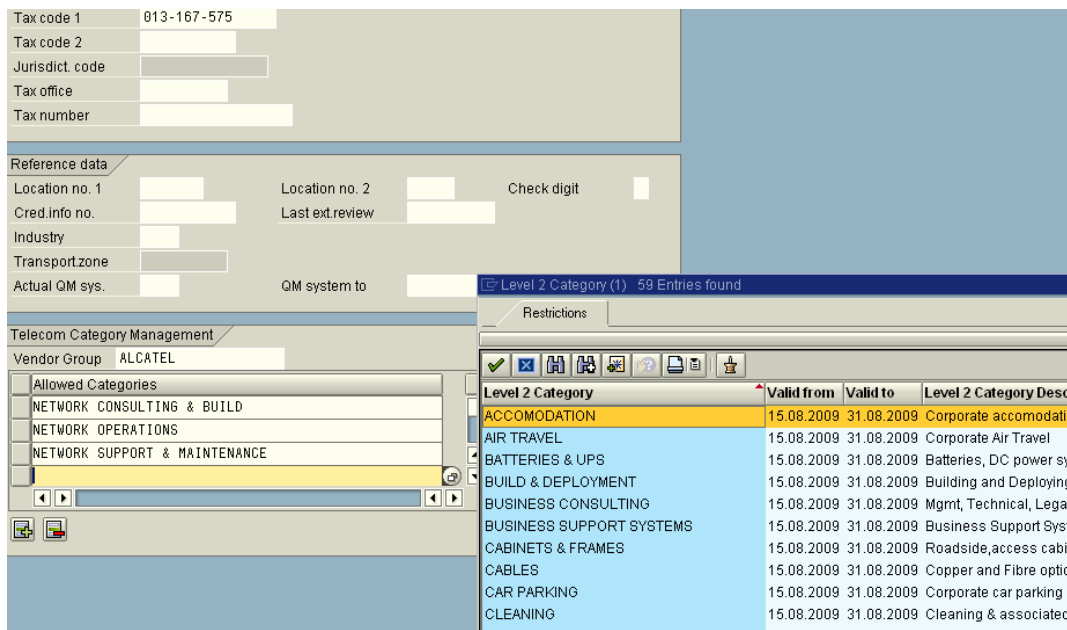
- Not all GL codes can be linked to a category. If no suitable GL code can be found, then the invoice is marked as 'Unassigned'. A new category called 'Unassigned' was created for this purpose. For the purpose of this study, these were subsequently cleansed and re-assigned.

At the end of this step, every invoice is associated with a category.

- Spend Report.** The data required to perform spend analysis was then extracted into a database (the spend cube) in the SAP BW system. A number of reports can be run against this cube. Category managers use this data to "slice" and "dice" information.
- Classify Suppliers.** This step is required to maintain ongoing data integrity.

- Group related suppliers. Multiple numbers for a supplier exist for a variety of reasons, most of which are legal or statutory. Examples of such instances are Microsoft Corp, Microsoft, Microsoft NZ, Microsoft Sales Tech etc. which are all part of Microsoft group but have separate GST numbers and are tracked separately. A “vendor group” field was added to group related suppliers for group spend reporting.
- Supplier-Category Link. The SAP system was amended so that suppliers could be associated with one or more spend categories. This is used for validating the material group when a PO is entered. The following screenshot from the SAP system (Figure 5.5) depicts the association of spend categories in the vendor master maintenance screen.

Figure 5.5: Associating vendors with categories



Source: Telecom NZ SAP system

5.3.3 Benefits of Spend Analysis.

The following benefits of spend reporting were identified by the project team.

- Easy identification of spend leakage by reviewing spend against non-preferred suppliers

- A view of total spend by category to drive cost or service benefits. This will ensure that rebate arrangements or volume break based pricing can be proactively manoeuvred to suit Telecom needs.
- Spend Analysis is a necessary input for supplier performance reviews and any negotiations/discussions
- Historical data can be used to enable forecasting and demand planning.

5.3.4 Category Architecture

Appendix A shows the final category architecture that was agreed by the procurement team. The grouping is relevant to business units.

5.4 Analysis of Spend Data

This section shows the results of spend analysis. It is based on the data obtained and cleaned from the SAP system as described above. The data used was for invoices between July 2008 and March 2010, a total of 21 months.

It must be noted that the quality and accuracy of the data was not very good and considerable manual effort was required to clean and categorise individual transactions.

5.4.1 Purchasing Spend as a percentage of revenue

The Purchasing Spend was compared with the revenue data available from the Telecom New Zealand Balance Sheet.

The total purchasing spend was 54% of the revenue.

5.4.2 Spend by Business Unit

Telecom has a number of business units. Table 5.1 below shows the purchasing spend by business unit.

Table 5.1: Spend by business unit

Business Unit	% Total Spend
A	35%
B	20%
C	15%
D	13%
E	7%
F	7%
G	4%
H	0%

As pointed out by Van Weele (2010), this information provides important information on the internal customer.

5.4.3 Spend by Currency

Table 5.2 below shows the purchasing spend by currency. Most of the purchases are in NZ Dollars.

Table 5.2: Spend by Currency

Currency	% Total Spend
NZD	78%
USD	15%
EUR	5%
AUD	2%
Other	1%

5.4.4 Spend by Vendor

A number of vendors exist at Telecom. The following was a summary obtained from the spend report

- Total No of Active Vendors = 3772
- 73% of spend is with 50 vendors
- 80% of spend is with 81 vendors
- 2581 suppliers got < NZ\$ 100,000 and represented 1% of the total spend.
- Over a thousand vendors got less than NZ\$ 5,000. This should be the first target for supply base reduction.

A number of duplicated vendor records exist. As mentioned earlier, there are a number of reasons why this could occur, the prime ones being because they are different legal entities having a separate GST or perhaps created in error. After grouping related, the following results were obtained.

- Total No of Active Vendor Groups = 3335
- 77% of spend is with 50 vendor groups
- 80% of spend is with 59 vendor groups

5.4.5 Spend by Category

The Purchasing spend by category level 1 is shown below in Table 5.3

Only the percentage figures are displayed rather than the actual dollar amount, in order to preserve confidentiality.

Table 5.3: Spend by Category Level 1

Category - 1	No. of Vendors	%Total Spend
Customer	152	11%
Facilities	519	1%
Field Services	273	17%

Category - 1	No. of Vendors	% Total Spend
HR	599	3%
IS Hardware	295	6%
Logistics	48	0%
Marketing	587	8%
Network Hardware & Software	220	15%
Professional Services	695	20%
Software	386	6%
Travel	269	1%
UnCategorised	1	0%
Unimpactable	428	11%
Grand Total	4472	100%

Key Points to note

- Services (Professional as well as Field Services) appear to be highest category of spend. Together they make up about 37% of the total spend.
- Spend in some of the categories may be lower than the actual value as it may be bundled in other items. Examples are Software, Logistics Facilities etc.
- The Mobile hardware spend was extremely difficult to categorise as it bundled into items under the Network Hardware & Software or Customer.

Table 5.4 breaks down the purchasing spend by the next lower level of detail, which is category 2.

Table 5.4: Spend by Category Level 2

Category - 1	Category - 2	No. of Vendors	% Total Spend	% Category Spend
--------------	--------------	----------------	---------------	------------------

Category - 1	Category – 2	No. of Vendors	%Total Spend	%Category Spend
Customer	Mobile Hardware	40	7%	66%
	Customer Content	38	2%	19%
	CPE	74	2%	15%
Facilities	Facilities Management	140	0%	32%
	Furniture & Fittings	63	0%	21%
	Property	58	0%	16%
	Hospitality & Catering	127	0%	9%
	Energy & Power	34	0%	8%
	Cleaning	32	0%	8%
	Office Supplies & Stationery	35	0%	5%
	Car Parking	30	0%	1%
Field Services	Build & Deployment	160	11%	65%
	FS Maintenance & Support	40	4%	22%
	Provisioning	5	1%	8%
	Engineering & Building Services	68	1%	5%
HR	Contract Labour	343	3%	81%
	Training	149	0%	12%
	Employee Welfare Health & Safety	61	0%	3%
	Permanent Recruitment	46	0%	3%
IS Hardware	Consumables & Peripherals	188	3%	45%
	Desktop & Laptop	28	1%	25%
	Servers	11	1%	22%
	Hardware Maintenance	50	0%	5%
	Printers	11	0%	3%
	Storage	7	0%	0%
Logistics	Post & Couriers	14	0%	79%

Category - 1	Category – 2	No. of Vendors	%Total Spend	%Category Spend
	Warehousing & Distribution	14	0%	11%
	Freight	20	0%	10%
Marketing	Media	160	5%	66%
	Agency	113	1%	20%
	Market Research	89	0%	6%
	PR & Sponsorship	135	0%	4%
	Print	54	0%	2%
	Promotional	36	0%	2%
Network Hardware & Software	Fixed Network	73	11%	77%
	Cabinets & Frames	4	1%	9%
	NW Maintenance & Support	112	1%	7%
	Cables	12	1%	5%
	Batteries & UPS	15	0%	1%
	Mobile Network	4	0%	0%
Professional Services	IS Operations	42	7%	34%
	IS Consulting & Build	217	5%	23%
	Network Consulting & Build	60	3%	17%
	Business Consulting	324	2%	10%
	Network Operations	12	2%	8%
	Outsourced Contact Centres	8	1%	5%
	Financial Services	32	1%	4%
Software	Licenses	160	4%	58%
	Software Support & Maintenance	174	2%	32%
	Purchased Software	52	1%	9%
Travel	Air Travel	6	0%	43%
	Travel & Event	152	0%	24%

Category - 1	Category – 2	No. of Vendors	%Total Spend	%Category Spend
	Management			
	Fleet	22	0%	13%
	Transport	24	0%	11%
	Accommodation	65	0%	9%
UnCategorised	General Expenses	1	0%	100%
Unimpactable	Interconnect & Roaming	131	9%	81%
	Government	55	1%	8%
	Data Revenue Comm & Profit Share	149	0%	4%
	YPG	1	0%	3%
	Dealer Payments	91	0%	3%
	Unassigned	1	0%	0%
Grand Total		4,472	100%	

The Spend Analysis reports have enabled Telecom NZ to unearth information that highlight opportunities for spend savings and process efficiencies. The categories that have the maximum spend are

- Fixed Network
- Build & Deployment
- Interconnect & Roaming
- Mobile Hardware
- IS Operations
- Media
- IS Consulting & Build
- Licenses
- FS Maintenance & Support
- Network Consulting & Build
- Consumables & Peripherals
- Contract Labour

The number of suppliers is also an important factor to consider from a supplier base reduction perspective. The categories that have the highest number of suppliers are shown below in Table 5.5.

Table 5.5: Categories and no. of suppliers

Category 2	%Spend	No. of Suppliers
Contract Labour	3%	343
Business Consulting	2%	324
IS Consulting & Build	5%	217
Consumables & Peripherals	3%	188
Software Support & Maintenance	2%	174
Licenses	4%	160
Media	5%	160
Build & Deployment	11%	160
Travel & Event Management	0%	152
Training	0%	149
Data Revenue Comm & Profit Share	0%	149
Facilities Management	0%	140

The presence of multiple suppliers for similar goods and services indicate the following:

- Opportunities for reducing the number of suppliers in some categories. This information can then be used to negotiate volume discounts with fewer suppliers which will provide purchase cost savings. Fewer suppliers in turn would lead to reduced transaction costs.
- Yet another way to reduce transaction and purchase costs is to standardise the range of items purchased.

A number of activities could be pursued to unearth further avenues for cost savings

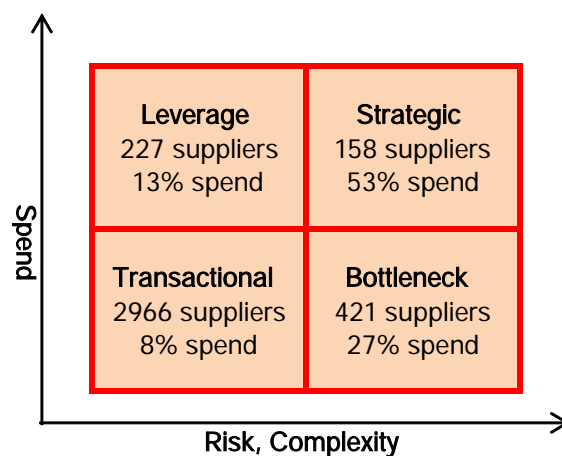
- Check existing contracts for these orders to identify maverick spend or use of contracted prices. This would result in identifying potential savings.

- Review the average invoice value and the profile of invoices by value and volume. This analysis could indicate
 - Opportunities to introduce purchase cards for low value invoices and one-off purchases where invoice processing costs may exceed the value of the order.
 - Invoice consolidation for single line invoices (ie only one item ordered). This will reduce the number of transactions and hence save transaction processing costs.
- Assess the extent of maverick spend (purchasing off contract - where contracts are in place but goods and services are being purchased from other suppliers).
- There are many instances of multiple name descriptions for the same supplier and hence an opportunity for data cleansing.

5.4.6 Kraljic Portfolio Analysis

As discussed in section 3.5.4, the objective of spend analysis is to assist in strategic sourcing. This needs to be performed by category and obtaining the break-up of spend by category paves the way for the next step. The Kraljic purchasing portfolio analysis is the next step. The suppliers were classified using the Kraljic classification and represented in Figure 5.6.

Figure 5.6: Kraljic Portfolio Analysis



A separate strategy applies to each quadrant based on the literature discussed in section 3.4.4.

Strategic Items

Strategic products and services represent a significant value to Telecom in terms of profit and complexity. In addition, most of the strategic products can only be purchased from one or two suppliers, causing a significant supply risk. In order to counterbalance this risk, Telecom must assess the partnership relationship with the suppliers in this category.

There are 133 suppliers in the strategic quadrant representing about 50% of the purchasing spend. The following options are available for these items.

- Maintain a strategic partnership. Telecom already has a strategic relationship with a number of these suppliers. For many suppliers, this is the suggested approach. It is expected that the mutual trust and commitment that comes with this relationship would minimise the supply risk. It would also lead to improvements in product/service quality, delivery reliability, lead times and in addition lead to cost reduction. Prime examples in this instance are field services, air travel etc. In some instances, because of the nature of the products or service, they must accept a locked-in relationship.
- Terminate a partnership. If the supplier's performance is unacceptable, the obvious option is to reduce the dependency. It may mean searching for alternative suppliers and in the worst case scenario even take a financial hit.

Bottleneck Items

Bottleneck products and services have less influence on the financial results of an organisation; however their supply is at risk. Suppliers have a dominant power position for these products. The purchasing strategy is therefore primarily focused on assurance of supply.

There are 421 suppliers in the bottleneck quadrant representing about 30% of the purchasing spend. The following options are available for these items.

- Accept dependence, reduce negative consequence. Examples of this category are fixed network hardware. For some items like PSTN, Telecom has strategies like keeping extra safety stocks. For other items, agreements are in place with the supplier for consignment stock. In this scenario, supplier pushes stock to a Telecom warehouse and Telecom pay only on usage. Whilst this does involve a degree of relationship between Telecom and the suppliers, it is not as involved as the strategic relationship.
- Reduce dependence and risk, find other solutions. The number of suppliers in this quadrant is rather high. It is suggested that Telecom look for new suppliers or find other solutions to reduce dependence on these products/services.

Leverage Items

Leverage products or services can be obtained from many suppliers. These items represent a relatively low supply risk. Thus Telecom has many possibilities and incentives for negotiation. These characteristics justify an aggressive approach to the supply market and a purchasing strategy directed towards exploitation of the buying power is pursued.

There are 217 suppliers in the leverage quadrant representing about 12% of the purchasing spend. The following options are available for these items.

- Exploit buying power. Telecom can pursue aggressive bidding and negotiation to reduce costs and get a better deal from the suppliers. As these products are freely available, there is no need for long term supply contracts.
- Develop a strategic partnership. Alternatively, Telecom can choose to go for a strategic partnership for some items. This will depend on the capability of the supplier and the item itself before a partnership arrangement is entered into.

Transactional Items

These items are usually of low value and many alternative suppliers can be found. From a purchasing point of view, these items do not cause any technical or

commercial problems but to the sheer volume consume a large chunk of the purchasing department's time.

There are 3001 suppliers in the transactional quadrant representing about 9% of the purchasing spend. This represents a fairly large volume of suppliers. The following options are available for these items.

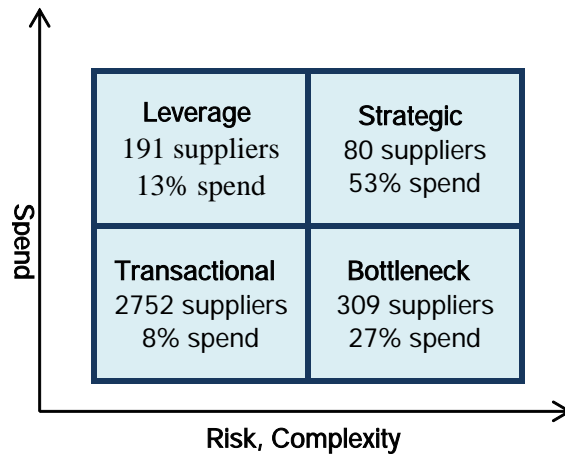
- Pool purchasing requirements. Effort must be taken to reduce logistics and administrative costs by bundling requirements. This has been undertaken in a limited scenario with success by asking the supplier to bundle commonly used components before sending out to the exchanges.
- Individual ordering, efficient processing. This is where simplification of the purchasing process and reducing transaction processing cost comes in very handy. Telecom has made considerable headway in this area by using a number of options like SRM catalogues, EDI with supplier for sending PO and receipt of invoices etc. This area is covered in more detail in the following section.

Supplier Base Reduction

Consolidating and standardisation of purchased goods and services, leads to supplier base reduction. Not only does it lead to concentrating purchase volume but also leads to a reduction in transactional costs and opportunities for negotiating volume discounts.

Before launching into the consolidation process, it was noticed that there were a number of duplicate vendor records. In addition, a number of vendors operated under different names. This was consolidated by adding an extra attribute for vendor group. The number of unique suppliers was reduced by 440. The Kraljic spend portfolio matrix was re-done with this supplier base and the results are displayed in Figure 5.7.

Figure 5.7: Kraljic Portfolio (Revised)



5.5 Supply Performance

This section discusses how supply performance is managed at Telecom. The performance aspects discussed are supplier performance and Telecom payment performance,

5.5.1 Shortlisted performance metrics

During the study, a workshop was conducted with the T&SS procurement team to discuss supplier and other performance metrics that are important to be measured. The proposed list is shown in Table 5.6. This served as a wish-list for the performance aspects to be measured.

Table 5.6: Procurement Process Metrics

	Source	Purchase	Pay	Review
Definition	Activities performed by the sourcing team after receiving requirements until contract agreed with	Placing the order until receipt of goods or service. May be based on a contract	Receipt of invoice from supplier until payment	Review of a purchasing entity - e.g. project, PO, contract and other supplier management

	Source	Purchase	Pay	Review
	supplier			
Key Activities	Manage Requirements	Purchase Order	Invoice Receipt & Entry	Project/Contract closeout
	Supplier Selection	PO Confirmation	Invoice Cancellations	Review supplier performance
	Contract Agreement	Goods Receipt	Credit/Debit Memos	Supplier management
	System Setup (Supplier, Contract, Integration)		Payment to Vendor	Manage SLA rebates, LD's, failures
Metrics	Change from Requirements at Contract sign stage	Use of preferred vs. non-preferred supplier	Blocked & parked invoices	Performance against centered SLA's
	Volume and value of changes from contract post sign-off	Analysis of PO Date vs. Invoice Date	Invoices requiring rework	Escalations, Re-negotiations, Use of liquidated damages
	Elapsed Time to put requirements together	Lead time for approval	Electronic vs. manual invoices	\$value (%) of non-compliant spend
	Cost impact of changes to project and ongoing	Order Accuracy	Exceptions to Invoice Match	Spend not covered by contract
	Changes to RFP/RFI	Order Description	Time to Pay	Termination for cause - incurring of cost
	% of responses received	Lead time for Goods Receipt	Credit Memos	Time to deliver vs. contracted time

	Source	Purchase	Pay	Review
	Reason code for supplier questions	GR Date vs. IR Date	Invoice Cancellations	Spend by supplier
	Supplier Setup prior to purchase	GR Date vs. PO Date	Aged analysis	Spend by category
	Supplier terms matches contract	GR Date vs. Requested Delivery Date	Invoices unable to be paid	Spend by business unit
	No of duplicate vendors	PO without contracts	Payment compliant with terms	Foreign Currency purchases

The list highlights a few shortcomings

- Forecast metrics were not perceived as important and hence not provided.
- Inventory Management does not appear to be an area of concern and hence there are no metrics requested.
- There is no focus on a wider supply chain as is evident from the lack of metrics.
- Supply quality performance is not measured and hence a distinct absence of metrics. There are a number of instances of poor quality and “out-of-box” failures in the field, however these are not being systematically captured and reported to the supplier.
- Aspects related to innovation, market research, safety and environment friendliness are not measured.

As part of this study, an attempt was made to obtain as many metrics as possible. However, it is not easy to regularly report on a number of these metrics as the required data is absent or not in a format to be easily reported on. The following examples clarify it.

- PO without contracts. The lack of contract information in the system means this cannot be reported on without significant manual effort

- Use of preferred vs non-preferred supplier. As above, preferred supplier information is not in the SAP system and hence cannot be easily reported on.
- GR Date vs Requested Delivery date. The delivery date agreed with the supplier is not entered in the system and hence this cannot be reported on with significant manual effort.
- There is no sourcing system and hence most of the metrics cannot be derived.

The metrics listed in Table 5.6 that were measured in this study are highlighted in bold and shaded in green boxes. This section considers the delivery and payment performance metrics. The rest of the metrics are discussed in other sections.

5.5.2 Delivery Performance Summary

Supplier delivery performance is typically the time taken by the vendor to deliver the goods in comparison to the expected delivery date as per the PO/contract. If the delivery is made on or around the original contracted date (within a suitable tolerance), then the performance is considered good.

The results were obtained from analysing the purchase order statistics from the SAP system. It is calculated as the difference between the expected delivery date and the goods receipt on the Purchase Order.

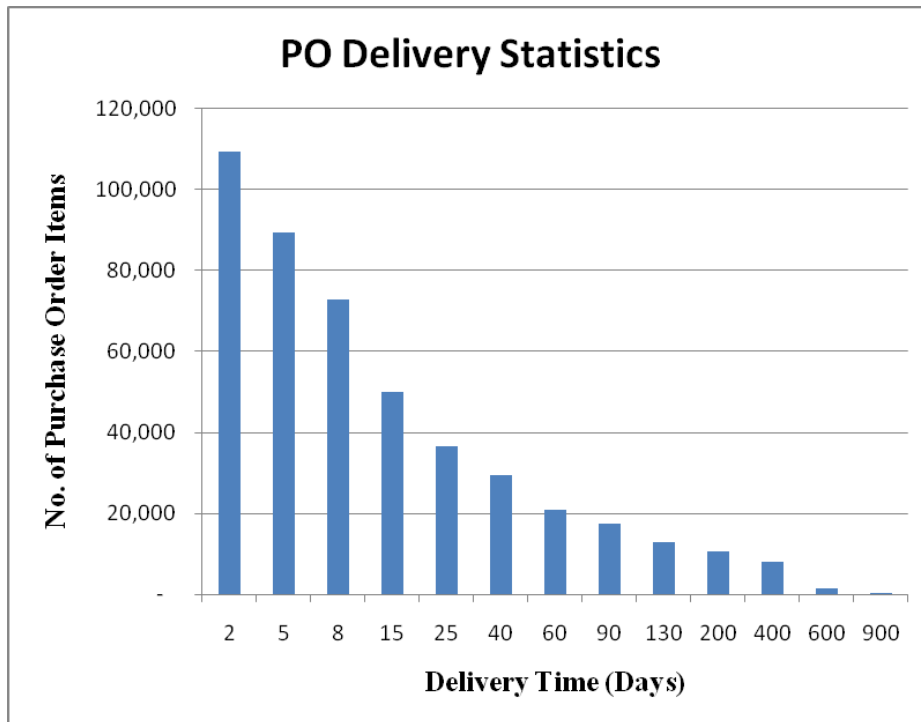
Figure 5.8: PO Delivery Statistics

Figure 5.8 shows a distribution of the delivery performance for the purchase orders created between July 2008 and March 2010. The graph clearly shows that a number of purchase orders have been delivered late.

A more detailed analysis is shown in Table 5.7 below and it depicts the delivery performance by category.

Table 5.7: Delivery Time by Category (Days)

Category 1	Category 2	No. of Mat Grps	No. of PO Items	Max Days	Avg Days	Min Days
Customer	CPE	13	17,570	787	66	42
	Customer Content	3	81	57	7	5
	Mobile Hardware	11	20,666	794	40	3
Facilities	Car Parking	1	19	8	7	3
	Cleaning	1	3,690	365	9	1

Category 1	Category 2	No. of Mat Grps	No. of PO Items	Max Days	Avg Days	Min Days
	Energy & Power	1	9	3	1	1
	Facilities Management	22	7,229	783	63	9
	Furniture & Fittings	1	145	407	59	1
	Hospitality & Catering	4	55,365	610	21	1
	Office Supplies & Stationery	6	41,913	471	18	2
	Property	1	109	316	16	1
Field Services	Build & Deployment	8	376	50	14	5
	Engineering & Building Services	3	15	48	16	9
	FS Maintenance & Support	5	63,947	803	35	9
	Provisioning	1	32	5	1	1
HR	Contract Labour	6	428	180	6	1
	Employee Welfare Health & Safety	7	9,435	468	10	2
	Permanent Recruitment	2	165	246	14	3
	Training	2	5,053	603	25	1
IS Hardware	Consumables & Peripherals	9	47,218	716	19	2
	Desktop & Laptop	7	14,143	583	30	2
	Hardware Maintenance	1	22	15	6	1
	Printers	1	3,361	547	15	1
	Servers	3	3,451	449	13	3
	Storage	1	5,346	669	16	1
Logistics	Freight	2	4,811	593	17	1
	Post & Couriers	2	3,039	439	26	1
	Warehousing & Distribution	3	981	264	17	1
Marketing	Agency	26	353	212	25	6
	Market Research	5	14,439	721	46	1
	Media	10	121	243	40	6
	PR & Sponsorship	4	181	168	14	5
	Print	13	4,342	784	57	10
	Promotional	3	116	154	13	1
Network	Batteries & UPS	2	2,700	306	50	1

Category 1	Category 2	No. of Mat Grps	No. of PO Items	Max Days	Avg Days	Min Days
Hardware & Software	Cabinets & Frames	3	2,626	384	60	2
	Cables	6	4,431	364	22	1
	Fixed Network	40	14,988	475	61	12
	Mobile Network	3	4	6	6	6
	NW Maintenance & Support	29	9,465	729	34	6
Professional Services	Business Consulting	8	5,909	728	68	15
	Financial Services	4	225	92	5	2
	IS Consulting & Build	6	120	327	16	6
	IS Operations	5	699	415	43	1
	Network Consulting & Build	3	15	27	20	20
	Network Operations	4	77	221	37	6
	Outsourced Contact Centres	1	12	43	20	13
Software	Licenses	1	22,371	553	10	1
	Purchased Software	2	13,023	532	32	1
	Software Support & Maintenance	1	1,894	546	92	1
Travel	Accommodation	1	502	663	35	1
	Air Travel	2	666	700	107	1
	Fleet	1	210	73	24	1
	Transport	2	1,121	321	6	1
	Travel & Event Mgmt	4	950	408	27	1
Unimpactable	Data Revenue Comm & Profit Share	1	1			
	Dealer Payments	1	16	84	13	1
	Gen-i Use only	5	45,583	698	21	1
	Government	2	22	4	2	1
	Interconnect & Roaming	5	2,779	607	8	2
	To be assigned	1	2,035	609	47	1
	Unassigned	5	7	14	9	9

As can be inferred, the delivery performance is very poor for a number of suppliers.

The following observations were made:

- Telecom has not been actively managing delivery performance and hence the drive to keep this information updated is lacking. As a result it is possible for suppliers to get away with mediocre performance.
- The actual delivery performance may be quite different to what is depicted. One reason for this is that the expected delivery date is not entered correctly in many cases. In the absence of any master data, the SAP system defaults the delivery date to the next working day when the PO is created. Changes (if any) must be corrected. It is important to do this not only to track delivery performance but also for expediting open purchase orders, work in progress and accruals to reflect cash flow. The extent of the inaccuracy of the data could not be determined and hence this information must be used with some caution.
- Yet another reason for the inaccuracy could be because of goods receipt performance. As discussed in section 5.2.6, the PO must be updated with the goods receipt status when the goods or services are received. Apart from delivery performance and open order tracking, invoices cannot be posted in the system if this step is not done. Unfortunately this step is often delayed and done just before invoice posting after multiple reminders.

So far, only delivery performance has been depicted only at a category level. To ensure that the results are interpreted correctly, it is important to analyse the performance at a lower level of detail. This requires knowing the correct lead times. This information is available in the SAP Plant Maintenance system and required considerable effort to extract and analyse it. Therefore, it has been done only for a subset of the data, i.e. fixed networks. Two aspects of delivery performance have been examined.

1. Procurement of Fixed Network Hardware.
2. Procurement of Services for Installation of the network hardware

As these are also relevant for the calculation of cash-to-cash cycle time, it is presented in section 5.7.4.

The following recommendations are made to ensure a useful supplier performance measurement process that will help Telecom achieve its cost reduction objectives.

- Supplier performance measurement should also include quality measurements.
- Wide supply chain performance metrics should be captured and regularly reported on. These include metrics related to forecasting and inventory management.
- The benefits of using material numbers for frequently ordered items have been mentioned. For these items, it is possible to enter the contracted price and lead time for delivery in the master data. Subsequently this information will default into the purchase orders
- The most important aspect is to ensure that the delivery dates and goods receipt updates are promptly made. Compliance to this must be actively measured and suitable action taken to enforce this discipline.

5.5.3 Payment Analysis

Once the goods and services are received and the supplier has sent in their invoice, Telecom must pay the supplier within the agreed timeframe specified by the payment term.

In the SAP system, the payment term is used for defining terms composed of cash discount percentages and payment periods. The payment term can be configured to suit the organisations requirements. A default value is typically assigned for a supplier and is entered in the supplier master data. This default value can be overridden with a different payment term when creating a purchase order or an invoice.

Telecom has setup the following payment terms in their SAP system to address their requirements. No prompt payment discounts have been defined.

- 07DY. Payment is due 7 days from invoice date.
- 10DY. Payment is due 10 days from invoice date.
- 14DY. Payment is due 14 days from invoice date.
- 20DD. Payment is fixed on the 20th of the month.
- 20DY. Payment is due 20 days from invoice date.
- 20MT. Payment is fixed on the 20th of the following month.
- 30DY. Payment is due 30 days from invoice date.
- NOW. Payment is due as soon as the invoice is received. This is generally used for staff, dealer and other recurring payments.

Invoices for the period July'2009 to February'2010 were analysed for payment performance against the payment term.

Table 5.8: Payment Analysis by Amount

Payment Term	Early	Late	On Time	Total
07DY	15.34%	1.35%	3.52%	20.21%
10DY				
14DY	2.55%	0.09%	0.13%	2.77%
20DD	2.03%	0.00%	1.01%	3.04%
20DY	0.75%	0.15%	0.15%	1.04%
20MT	39.47%	0.59%	22.97%	63.03%
30DY	2.59%	0.03%	0.37%	2.99%
NOW		1.37%	6.90%	8.27%
Total	62.72%	3.57%	33.70%	100.00%

The payment date and the invoice receipt date was analysed based on the payment term and each invoice payment was categorised as Early, Late or on Time. A practical tolerance was used to judge the data. The results are shown below in Table 5.8 and Table 5.9; the former is by amount and the latter is by invoice volume. For confidentiality reasons, only percentage figures are displayed.

Table 5.9: Payment Analysis by Invoice Volume

Payment Term	Early	Late	On Time	Total
07DY	28.00%	2.39%	8.16%	38.55%
10DY				
14DY	4.04%	0.02%	0.09%	4.15%
20DD	0.13%	0.00%	0.10%	0.23%
20DY	0.02%	0.00%	0.00%	0.02%
20MT	25.66%	0.72%	26.45%	52.83%
30DY	1.51%	0.03%	0.55%	2.08%
NOW		0.24%	1.78%	2.01%
Total	59.35%	3.41%	37.24%	100.00%

The above analysis indicates that over 62% of the supplier payments were made early. Assuming an interest rate of 2%, it equates to a substantial amount of money lost due to the early payments. There may be a number of reasons why this occurs.

- One reason for this could be that the invoices were parked or blocked and the payment was already overdue but not reflected in the document date.
- Another reason could be that the date range specified in the automatic payment run covers a long time span and as a result all the invoices are selected for payment irrespective of date. This must be addressed as soon as possible.

Opportunities exist to gain further savings by reviewing and rationalising payment terms for key suppliers and negotiating prompt payment discounts.

5.5.4 Future Opportunities

Whilst the above analysis is a good starting point, ultimately other factors must be considered to provide a more holistic view of supplier performance. The following scorecard (Figure 5.9) would be a good starting point especially for the key vendors.

Figure 5.9: Example Supplier Scorecard

Sample Supplier Performance Scorecard

Supplier	XYZ Ltd.		
Technology	DSLAM		
No. of Materials (MPN)	100		
Total Spend (NZ Dollars)	125,000		

	Weight	Score	Weighted Score
A Product Quality			
Inbound shipment quality	15.00%	3	0.45
Quality Improvement	5.00%	3	0.15
B Delivery			
On Time	10.00%	2	0.2
In Full	10.00%	4	0.4
C Costs			
Price compared to competitors	10.00%	3	0.3
Collaborate in cost reduction	5.00%	1	0.05
Payment Terms	10.00%	3	0.3
D Service			
Problem resolution ability	10.00%	3	0.3
Technical ability	10.00%	5	0.5
New product development	5.00%	5	0.25
Participate in VMI, ASN	5.00%	1	0.05
Electronic Integration	5.00%	2	0.1
Total Rating			3.05

Rating	Score
Excellent	5
Average	3
Poor	1

5.6 Information Technology

5.6.1 Current use of IT in Procurement at Telecom

Information Technology plays a very important role at Telecom for procurement. The IT environment at Telecom comprises of the following application components

- SAP R/3. This is the core ERP system and is used for processing Financials, Inventory Management, Procurement, Sales, Distribution, Projects etc. It also contains all the necessary master and transactional data. From a purchasing perspective, most of the purchases occur in this system. However as purchasing is centralised, only a few people have access to create purchase orders in the system.

- SAP SRM. The Supplier Relationship Management system. This is part of the SAP suite of applications and is used for catalog based purchases over the intranet and extranet.
- SAP BW. This is SAP's data warehouse product and is used for reporting on data transacted in the SAP ERP system. This data is transferred to the BW data warehouse from where it is used for analytical reporting. The frequency of updates and content of the reports is setup to suit specific reporting requirements.

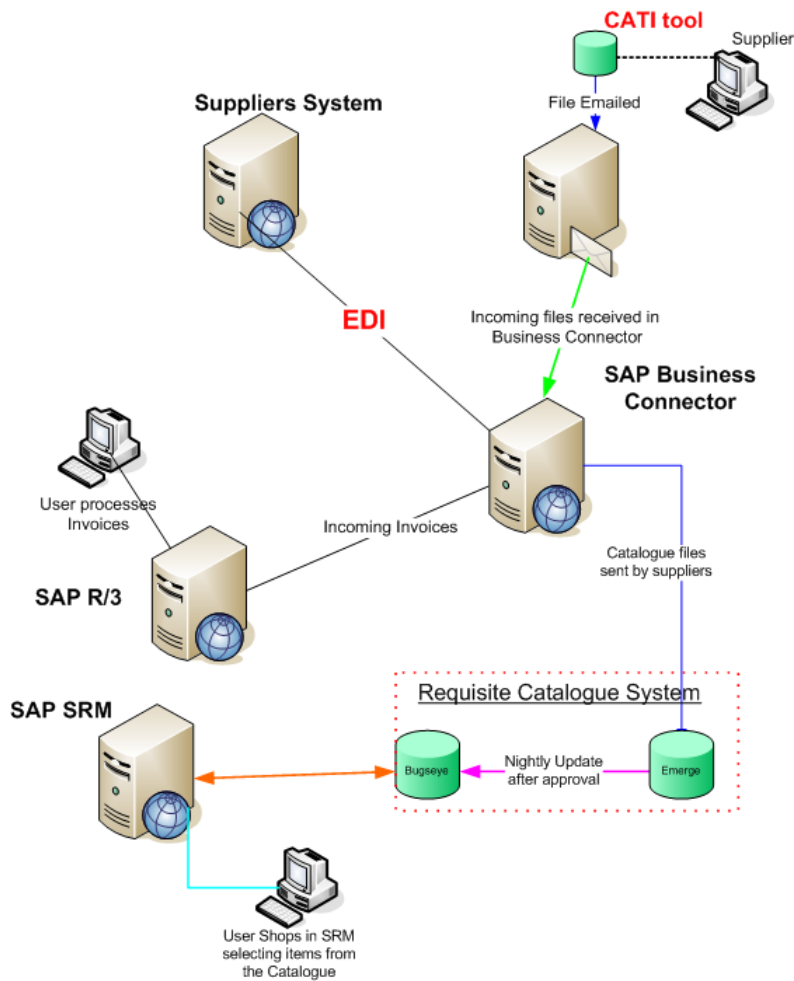
From a wider supply chain perspective, there are a number of systems that are used for planning and execution. Each business unit uses them differently.

- In general, there is no single ERP system that is used by Telecom for core functions like sales order processing, distribution, warehouse management etc. A number of systems are used each having its own set of information and there is very little integration across the business units or with procurement.
- The use of supply chain planning systems is limited. In the fixed network business unit, use of MRP is made for spares replenishment/repair planning. In general, there is a marked lack of usage of information technology for network optimisation, supply and demand planning.
- The use of supply chain execution systems is more prevalent. Almost all business units use SAP R/3 and SRM for procurement (albeit in varying degrees). The Gen-I business unit uses SAP for sales and distribution, warehouse management. The fixed network business unit uses warehouse management for network spares. All other business units either use other systems or do not manage their items by SKU. This makes it very difficult to get an overall view or for reporting.
- A number of data warehouse systems exist to provide corporate reporting. As described earlier, there is very little information sharing and a distinct lack of a data model makes company wide reporting extremely difficult.
- From a procurement perspective, there is little control on the data entered into the purchasing system. As mentioned earlier, extensive effort had to be expended to

cleanse the data to produce some of the analysis figures. There has not been an end to end procurement report.

Electronic Communication is enabled at Telecom for a few suppliers. There are two ways in which it has been setup (See Figure 5.10).

- EDI (Electronic Data Interchange) is a direct electronic communication from Telecom's SAP system with the supplier's ERP system. This requires significant effort on both sides to setup and test connections. Therefore, it is economical to implement only when the volumes are high and the need for swift and error free communication is vital. Typically EDI is bi-directional and can be used to interface a number of, however Telecom uses it primarily in two scenarios:
 - Purchase Orders are sent from Telecom to the supplier and as a result Sales Orders are created in the supplier system.
 - Once the goods are sent, the supplier's invoice is sent to Telecom and it directly creates AP invoices in the Telecom SAP system.
- A simpler interface is provided via the CATI application. This is a customised program developed in Microsoft Access and is provided to the supplier. The supplier either enters the data manually or uploads it from their system. The tool then validates this data as per Telecom requirements, formats into XML and sends it to Telecom via standard email. It is then processed automatically and creates the required documents in the SAP system. It is unidirectional and is used for the following at Telecom:
 - To create and update their catalog data
 - To submit invoices.

Figure 5.10: Electronic Supplier Interaction

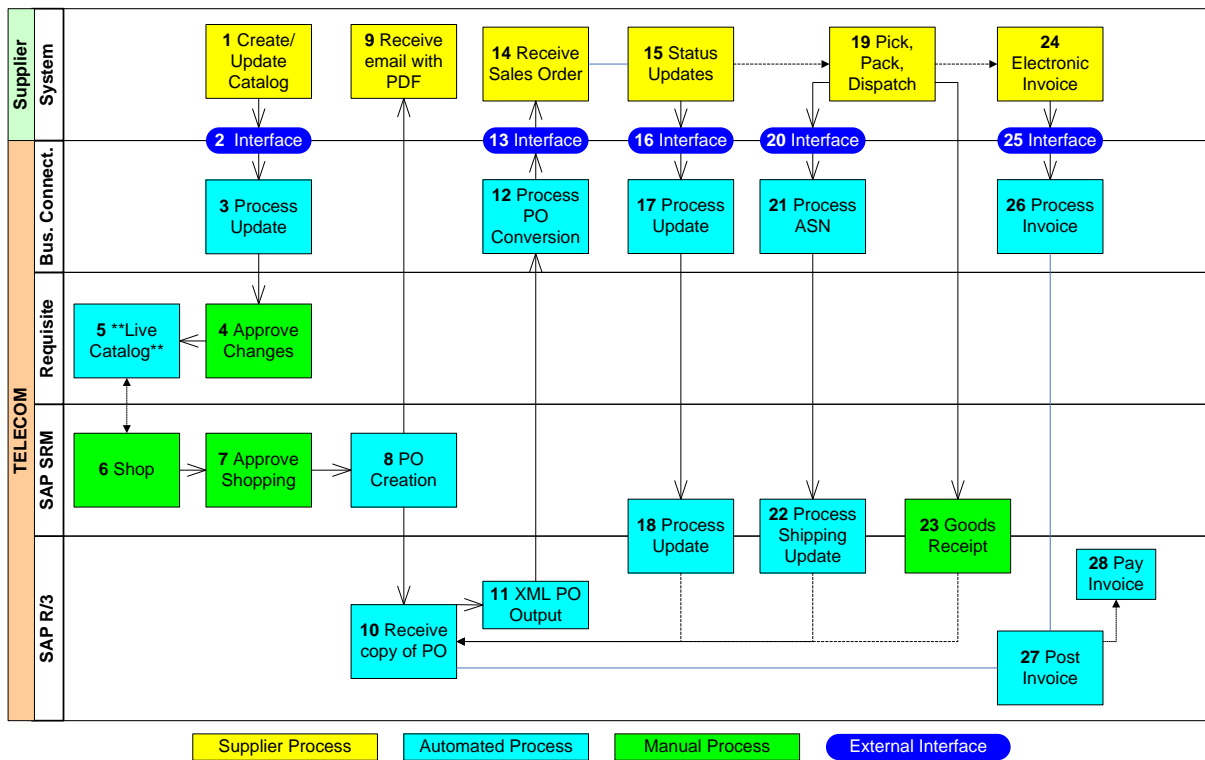
Source: Telecom NZ

Figure 5.11 shows the process steps involved in the current electronic communication with suppliers. The main interface points are

- Step 2 – Catalog Update – Supplier sends an update to the SRM catalogue when new items are created or existing items are modified (e.g. price change)
- Step 13 – Sending a PO from Telecom to the supplier. Telecom sends a PO to the supplier when it is approved and has all the necessary information.

- Step 16 – Status Update from the Supplier (e.g. Order Acknowledgement). Supplier accepts the PO and sends an update to Telecom. Any supplier delivery performance monitoring should use this information.
- Step 20 – Advanced Shipping Notification sent from Supplier to Telecom when goods are shipped out to Telecom.
- Step 25 - Supplier sends invoice to Telecom. This creates an AP invoice in the system.

Figure 5.11: Electronic Communication with Supplier



Source: Telecom NZ

5.6.2 Purchasing Document Analysis

For the purpose of this analysis, purchase orders and invoice documents for the period July 2008 to March 2010 was used.

Basic Purchasing document statistics

Total No. of Purchase Orders	192,850
- No. of Electronic PO's	89,718 (about 47%)
- No. of Purchase Order Items	433,201
Total No. of Invoices	298,358
- No. of Electronic Invoices	116,781 (about 39%)
- No of Invoices with a PO	192,850 (roughly 65%)
- No. of ERS Invoices	2,500 (about 1%)
- No. of Recurring Invoices	23,210 (about 8%)
- No. of Upload Invoices	11,410 (about 4%)

Purchases in SRM

Purchases using SRM comprise about 25% of the total volume but only 2% of the total value. SRM is used to purchase frequently ordered items based on a supplier catalog. About 50 suppliers participate.

Invoices by Supplier

Table 5.10 below shows an analysis of invoices by supplier.

Table 5.10: Invoice Analysis by Supplier

Invoice Count		No. of Suppliers
From	To	
0	10	2168
11	30	913

Invoice Count		No. of Suppliers
From	To	
31	50	230
51	100	176
101	200	128
201	500	78
501	1000	33
1001	2000	20
2001	4000	15
4001	10000	8
10001	20000	2
20001	40000	1

As can be observed, most of the suppliers have very few invoices. Very few suppliers have a large number of invoices. This fact is important in deciding the e-procurement strategy.

Usage of Material Number

A material number uniquely identifies an item in the SAP system. It is also called product number or SKU number and is a key master data element. Related information like supplier, price, unit of measure, storage conditions, inventory valuation, description, purchasing texts, inspection conditions, material group can be associated with this number.

A purchase order must contain most of the important information mentioned above. If a material number is entered, then all the available information can be defaulted from the pre-defined master data (if maintained). The advantages of having a material number are as follows (based on the author's experience as an SAP consultant)

- Reduces data entry time on PO by defaulting key information as described above.
- Reduces errors in data entry as key information is defaulted. A one-time effort is required to setup the master data.
- Material numbers are used to track adherence to contracted prices in the SAP system. Without this, there is no point in maintaining contracts in SAP as the price cannot be automatically populated in the call-off purchase order.
- All stock items received into SAP inventory must have a material number.
- Inventory valuation in SAP requires a material number.

Table 5.11: Invoices with material number

Material Exists?	% Value	% Invoices
No	90%	43%
Yes	11%	57%

From Table 5.11, it can be inferred that whilst over half the volume of invoices contain a material number, it constitutes only a small percentage of the value.

Material Number Analysis by PO Type

When entering a purchase order in the SAP system, the user must select a PO type. The PO type is configured to represent a specific purchase process and is also used to control access to the purchase. Analysis of spend by purchase order type reveals the following (Table 5.12).

- Material number is used mainly for catalog based purchases like stationery, office supplies, liquor, network spares and Gen-I sales based purchases.
- SRM purchases comprise around 2.5% of the value.
- 25% of the spend does not have a PO.
- Most Gen-I purchases have a material number.

Table 5.12: Spend by PO Type

PO Type	PO Type Description	Material?	% Total Spend
	AP Only Invoice - No PO	No	23.90%

PO Type	PO Type Description	Material?	% Total Spend
IN	Repair Orders	Yes	0.22%
OS	Overseas Purchases	No	14.10%
OS	Overseas Purchases	Yes	0.73%
ZGP	Gen-I Sales related purchases	No	0.04%
ZGP	Gen-I Sales related purchases	Yes	8.02%
ZGS	Services/Spares purchases	No	0.02%
ZGS	Services/Spares purchases	Yes	0.05%
ZPT	SRM Catalog	No	1.43%
ZPT	SRM Catalog	Yes	0.86%
NB	All other purchases	No	50.55%
NB	All other purchases	Yes	0.07%
Total			100.00%

5.6.3 Opportunities for leveraging Information Technology

A number of opportunities exist to make use of information technology to optimise the various aspects of the purchasing process.

- **Forecast.** Information Technology could be used to help create a supply plan based on a demand forecast. There is a choice of planning systems available for this purpose. An example of such a system is SAP APO that has modules to create a demand forecast and then match supply and demand to generate purchase requisitions.
- **Source.** A number of technology options are available in this area. Examples are e-tendering, contract management and category management. As highlighted in the sourcing process review, managing purchases against contracts is of prime importance.

The current SAP system already has functionality for contract management that can be used to create contracts and manage purchases against them. SAP offers a

number of ways to use this. One or more of the following options can be used depending on the process requirements.

- For some items/suppliers, the contract can be represented in the form of a supplier catalogue.
- For others it can be represented in the form of a source list. When a purchase requisition is converted to a PO, the supplier and price related information is automatically used.
- In some instances, it may be preferable to create the contract document in the system. It can be in the form of a volume or quantity contract or a scheduling agreement. Purchase orders can then be “called off” from the contract.

This will help in reducing the extent of maverick spend and enforce compliance to preferred suppliers. In addition it also cuts down searching and processing time.

- **Order.** A number of opportunities are available to enhance this process.
 - ERP systems like SAP offer a number of ways to purchase goods depending on the business requirement. Typically most organisations would use a few types of purchase orders to represent different processes.

Table 5.12 lists the current Purchase Order types currently in use at Telecom. However there are other purchase order types that can be used to better represent specific purchase processes at Telecom. Examples include

- SRM Limit Order. This allows a framework or blanket PO to be created with an upper limit on the dollar value for a pre-defined period without the need to specify the item in detail or performing a goods receipt. It would be very useful for low value services that occur monthly like lease, cleaning, equipment rentals but with a pre-set upper limit.
- SRM Adhoc purchases. Currently the SRM system in NZ can be used only to order items already in the catalogue. This function allows the requestor to enter a text description for the item to be purchased if there are no appropriate items in the catalog. Sufficient information has to be

provided to assist the professional buyers in finding the appropriate supplier and price. This would require approval before sourcing but save a lot of time and effort in re-typing the order.

- SRM Services Procurement. This is ideal for sourcing and procuring “time and materials” based services e.g. consulting. It can be used in conjunction with SAP’s “Supplier Self-Service” or SUS, whereby the supplier logs in to the buyer’s portal to perform confirmation of service or invoice entry.
- E-procurement, workflow and other features of SAP can be used to reduce the number of steps in this process. Table 5.13 depicts how this could be used for purchasing in SAP R/3. Table 5.14 depicts how it would help with purchasing in SAP SRM.

Table 5.13: Streamlining R/3 purchasing process

<u>Current State</u>	<u>Enhancement by IT</u>
Search for goods or services	Continue as before
Requisition for purchase --> Fill out Excel form on Intranet	Use SAP requisition
Email to authorised buyer --> Submit via Excel form	Not Required
Waiting..... in buyer's Inbox	Not Required
Buyer reviews requisition for completeness	Not Required
Optional: Buyer queries requestor for missing information	Not Required
Buyer enters Purchase Order in SAP and emails to requestor	Not Required
PO automatically sent for approval from SAP	Automatically from SAP
Waiting..... in approver's Inbox	Continue as before
Optional: Approver queries requestor	Continue as before
Approver releases PO in SAP for purchase	Continue as before
PO automatically emailed or printed/sent to requestor	Not Required
Send PO to supplier by fax or email	Automatic send from SAP
Supplier confirms acceptance of PO via fax, email or phone	Automatic update in SAP
Supplier notifies completion of PO via fax, email or phone	Not Required
Notify buyer via email to mark PO for delivery completion	Not Required

<u>Current State</u>	<u>Enhancement by IT</u>
Waiting..... in buyer's Inbox	Not Required
Set "Goods Receipt" flag in SAP and notify requestor	Automatic update in SAP
Optional: Entry of details like serial number in SAP PO	Automatic update in SAP

Table 5.14: Streamlining SRM purchasing process

<u>Current State</u>	<u>Enhancement by IT</u>
Search for goods or services	Continue as before
Requisition for purchase --> Fill out Excel form on Intranet	Use SAP requisition
Email to authorised buyer --> Submit via Excel form	Not Required
Waiting..... in buyer's Inbox	Not Required
Buyer reviews requisition for completeness	Not Required
Optional: Buyer queries requestor for missing information	Not Required
Buyer enters Purchase Order in SAP and emails to requestor	Not Required
PO automatically sent for approval from SAP	Automatically from SAP
Waiting..... in approver's Inbox	Continue as before
Optional: Approver queries requestor	Continue as before
Approver releases PO in SAP for purchase	Continue as before
PO automatically emailed or printed/sent to requestor	Not Required
Send PO to supplier by fax or email	Automatic send from SAP
Supplier confirms acceptance of PO via fax, email or phone	Automatic update in SAP
Supplier notifies completion of PO via fax, email or phone	Not Required
Notify buyer via email to mark PO for delivery completion	Not Required
Waiting..... in buyer's Inbox	Not Required
Set "Goods Receipt" flag in SAP and notify requestor	Automatic update in SAP
Optional: Entry of details like serial number in SAP PO	Automatic update in SAP

- **Pay.** As with the previous step, e-procurement, workflow and other features of SAP can be utilised to improve efficiencies. Table 5.15 depicts how this could be used to reduce the number of steps in the invoice entry and payment process

Table 5.15: Streamlining the payment process

<u>Current State</u>	<u>Enhancement by IT</u>
Supplier sends tax invoice to Telecom via fax or email	Automatic update in SAP
Invoice received by Accounts Payable (AP) team	Not Required
Waiting..... in AP team's Inbox	Not Required
Invoice is scanned into the system using OCR software	Not Required
Invoice is verified visually for errors	Not Required
Optional: Query supplier/requestor for missing information	Not Required
Invoice released for processing in SAP	Not Required
Invoice automatically matched to PO - 3-way match	Automatically in SAP
Optional: Review parked or blocked invoices and correct	Continue as before
Release for payment	Continue as before
Electronic payment to supplier automatically from SAP	Automatic send from SAP

- In some situations, the supplier need not send an invoice if the ERS (Evaluated Receipt Settlement) process is used. Here, the system automatically creates an invoice when the buyer confirms the goods receipt.
- Where necessary, the SAP system can be setup to make recurring payments for purchases of regularly occurring services.

Thus it can be seen that there are a number of ways to reduce process steps and improve efficiencies using Information Technology.

5.6.4 E-Procurement Strategy

Section 3.6.3 discussed the benefits of e-procurement. It also showed that the technology is vast and fast changing. The availability, cost, usage and maturity of the technology in a New Zealand context must also be taken into consideration.

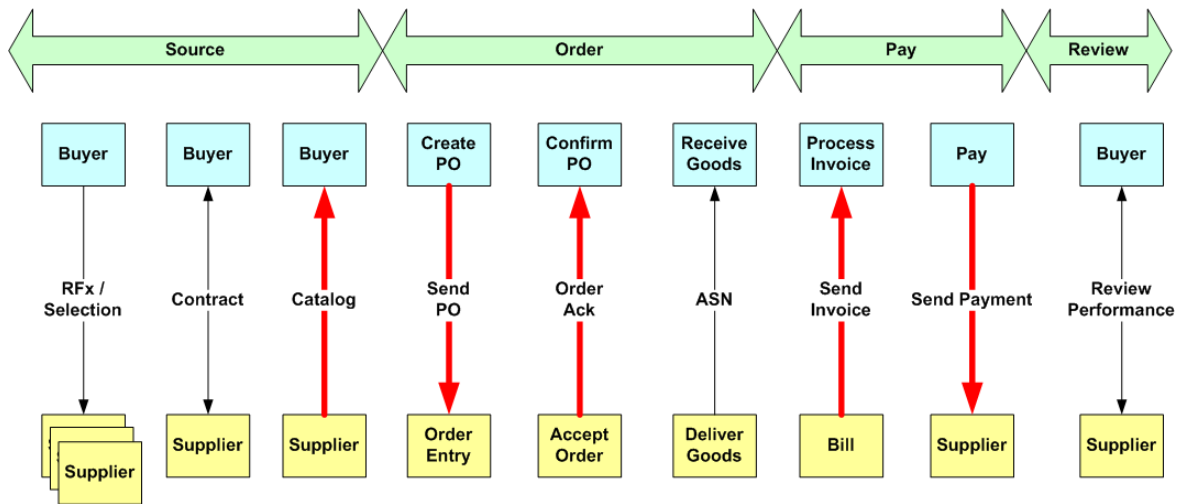
During the study at Telecom, the author undertook a review of the current technologies and provided recommendations on suitable technologies. This section summarises the results of the study. Table 5.16 shows the available technology options which have been matched to the relevant procurement area and process steps. Where a particular option is used in Telecom, it is also shown.

Table 5.16: E-Procurement options by process

	Processes	Technology Options	Telecom Usage
Forecast	Demand Planning Supply Planning	CPFR VMI	
Source	RFx Negotiation Supplier Selection Contract Management	E-Marketplace - Vertical - Horizontal Auctions - Open RFI/RFP - Reverse Auction - Forward Auction ERP - Direct - Email Extranet (Supplier self-service)	
Product Selection	Purchase Requisition Approval	Catalog (Employee self-service) - Buyer Hosted - Supplier Hosted - Third Party Hosted Automatic generation in ERP - MRP - Sales/Service Order - Maintenance Work Order etc.	SAP SRM SAP R/3 SAP R/3 SAP R/3
Order Processing	Purchase Order Order Acknowledgement Delivery & Receipt (ASN) Invoice Receipt	ERP - Direct - EDI - Email Attachment / PO Flip - Upload via interface Extranet (Supplier self-service)	 SAP R/3 SAP R/3 SAP R/3 SAP SRM

	Processes	Technology Options	Telecom Usage
		ERP via Intermediary (Marketplace) - EDI - PO Flip - Email - Supplier self-service P-Card/Credit card	SAP R/3
Payment	Invoice Entry (Other) Invoice Verification Supplier Payment	Scan with OCR Software - Internally in AP team - via Outsource Partner Automatic generation in ERP - ERS - Recurring Payments Electronic Payment - Direct Bank Transfer - Cheque	Readsoft to SAP SAP R/3 SAP R/3 SAP R/3 SAP R/3
Review	Close-out Performance Check Spend Analysis	ERP - Various Spend Analytics	SAP R/3 SAP BI

This exchange of information exchange is depicted in more detail in Figure 5.12.

Figure 5.12: Elements of E-Procurement

The bold lines in red show the electronic communication currently in use at Telecom (albeit with a few suppliers). They are

- **Catalog Creation.** Catalogues are electronically maintained in the SAP SRM system for about 30 suppliers using the “sell-side” approach. The supplier sends all relevant information for new entries and changes. Opportunities exist for extending this to other suppliers.
- **Send PO.** When a new PO is created and approved, it is automatically sent to the supplier using EDI. Currently there are only about 27 suppliers with whom this occurs and this could be extended to other suppliers.
- **Order Acknowledgement.** It is normal practice for a supplier to review and confirm acceptance of the PO terms and conditions (e.g. price, quantities, delivery dates, and payment terms). Electronic acknowledgment has been implemented using EDI but only for one supplier.
- **Send Invoices.** Suppliers send invoices using either the CATI tool or EDI approach. About 23 suppliers fall into this category.

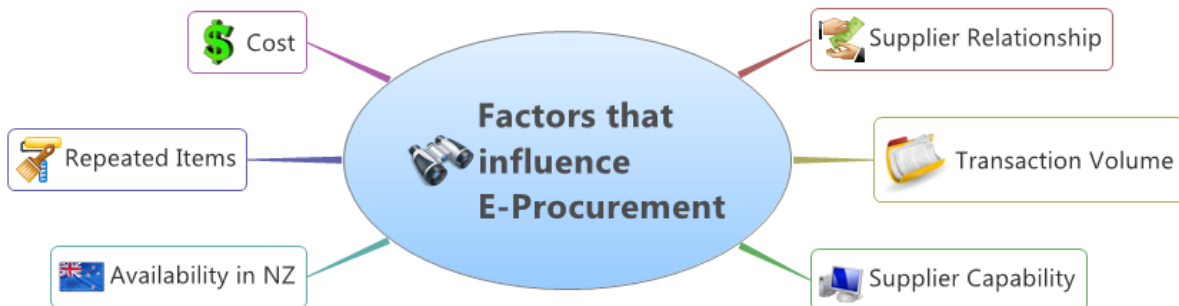
The thin black lines show opportunities for introducing other areas of e-procurement. It is recommended that a proper e-procurement strategy be developed before finalising the options.

From Telecom’s perspective, e-procurement should meet the following objectives

- Speed up processing so that they can avail of prompt payment discounts with suppliers
- To ensure that preferred suppliers and contracted prices are being used
- Reduction of errors
- Reduction of blocked invoices
- Standardisation of processes to improve compliance
- To reduce inventory by having a “just in time” approach

The selection of a particular e-procurement option depends on many factors as shown in Figure 5.13.

Figure 5.13: E-Procurement selection considerations



Based on these factors and the available solution options, the following usage is recommended.

1. Buy-side catalog. This is already in use at Telecom mainly for indirect materials and MRO spares. It has been deployed via SAP SRM and the catalog is kept maintained either by the supplier using a custom developed interface (CATI as shown in Figure 5.10) or sent via email to an internal employee who uploads the

catalog into SRM. It is recommended mainly for frequently purchased items, high volumes and with a preferred supplier with whom a contract exists.

2. Sell-side catalog. While this is not used at Telecom, it would be worthwhile to have a “punch-out” catalog integrated with SAP SRM. This would cater for items where a preferred supplier arrangement still exists but for one-off items.
3. EDI. This solution already exists and is implemented with a few vendors. It is used for sending the PO to the supplier, receiving an order acknowledgment from the supplier and then receiving an invoice. The EDI mechanism is used only where a long-term strategic relationship exists with a supplier and where the transaction volumes are high. The repeatability of the items does not matter. It is costly and difficult to implement EDI as it requires development of an agreed interface at the supplier and the buyer end.
4. PO Flip. This is relatively easy and inexpensive to implement. An email is sent to the supplier with the PO as an attachment (typically in ‘pdf’ or Adobe Acrobat format). The pdf document is programmed with buttons for submitting acknowledgements, ASN and invoice. The supplier receives the document and as and when they are ready to acknowledge, confirm delivery or invoice they press the button which emails the PO details back to the buyer. This is then processed in the SAP system. The “Adobe Interactive Form” feature of the current SAP system can be used. This scenario is especially useful for low purchase volumes and requires no investment from the supplier.
5. Supplier Portal. The supplier self-service (SUS) portal feature of the current SAP system can be used to create a portal with a web front-end. Supplier can access the portal to pick up their purchase orders or update acknowledgement, delivery, status or invoice information. The corresponding transaction is immediately updated. As with PO flip, it requires a one-off investment to setup the portal and is useful when volumes are low. The status update makes it very useful for tracking bottleneck supplies. Suppliers can access it via the Internet browser and update as required.
6. Marketplace. Marketplaces are a much used term and are used to cover a wide range of services. Basically, they are an “intermediary” that connect buyers and

suppliers. Horizontal and vertical exchanges are not common in New Zealand. There are instances of “store and forward e-procurement services or private B2B exchanges in Australia and to a lesser extent in New Zealand that deal mainly with purchasing transactions. Examples are Quadrem, Conexa and Unimarket. The buyer must first establish a EDI connection with the marketplace vendor. The transaction is store on the marketplace server and is then transferred to the suppliers using EDI, PO Flip or self-service portal depending on the supplier capability and volumes. The advantage of this is that the buyer has only one type of interface with the marketplace. They in turn establish a variety of interfaces with different suppliers. Apart from flat usage fees, a fee must also be paid for transaction.

- 7. OCR Invoice Scanning. This is used to process paper invoices and can be phased out as electronic receipt becomes more prevalent.

Base on the invoice volumes shown in Table 5.10, there are a number of low volume suppliers. It is advisable for Telecom to initially proceed with the low investment opportunities like PO Flip and supplier portal that address the group of low volume suppliers. Some of the high volume suppliers already use the EDI solution. It is recommended that the current EDI solution be extended to the others. Thus marketplaces are not recommended at this stage.

5.6.5 IT Systems Maturity


An attempt is made to assess the IT systems maturity as described by Heinrich & Simchi-Levi (2005) in Section 3.6.2. The parameters used for the assessment are shown in Table 5.17.

Table 5.17: IT Systems Maturity

Business	Disconnected Processes	1
Process	Internal Integration	2
Maturity	Full internal integration and some external integration	3
	Extensive integration among many organisations	4



IT Systems Framework	Silos and Spreadsheets	1
	Shared data across the supply chain	2
	Shared processes and data	3
	Widespread collaboration	4



From a supply chain perspective, the overall the IT systems maturity is somewhere at the upper end of quadrant A (as depicted in Figure 3.18), or in other words Immature.

The reasons for this are as follows:

- Business Processes are disconnected with little or no integration across functions. E.g. The S&OP planning process is not integrated with procurement. Demand planning from a customer perspective does not appear to be integrated into the rest of the supply chain processes. There is no conscious effort to manage Inventory levels. There is a lack of a clear and consistent supply chain management process and no evidence of supply chain metrics being measured.
- There are a number of IT systems but it lacks the integration and data sharing across the supply chain. There are no planning tools used for managing the supply chain. However it is not in silos and spreadsheets and hence it ranks a 1.75.

5.7 Supply Chain Analysis

So far, the study has been limited to procurement related aspects of Telecom. In this section, the analysis has been extended to a broader supply chain focus. The SCOR model developed by the Supply Chain Council has been used for this. As a significant amount of data and process understanding was required, this study has been restricted to the broadband technology of the “fixed networks” business unit.

5.7.1 Overview

The first step in the SCOR methodology is to list the various supply chains that exist at Telecom. These are listed by product stream, by geography or business unit. Table 5.18 shows an example of a matrix. However, this has been developed as a quick prototype to show the advantages of using this approach. It should not be used for any decisions without conducting a proper assessment. Some important supply chains are:

- Mobile, Broadband and Voice: These are network related and involve the Retail, Wholesale and Chorus business units.
- Data and backhaul: These involve the Wholesale and Chorus business units.
- IT Services: Gen-I business unit related

Table 5.18: Supply Chain Definition Matrix

Product	Geography			
	Retail	Gen-i	Wholesale	Chorus
Mobile	X		X	X
Broadband	X		X	X
Data			X	X
IT Services		X		
Backhaul			X	X
Voice	X		X	X
Interconnection			X	
Network Infrastructure				X
Unbundling				X
Field Force Services				X
FTTN				X
FTTP				X

The prime focus is the fixed networks equipment which comprised of mainly broadband. The key equipment for implementing a broadband service is the ISAM (Intelligent Service Access Module). This can be installed in the exchange or in a roadside cabinet. Figure 5.14 depicts an ISAM in a roadside cabinet.

Figure 5.14: ISAM in a roadside cabinet

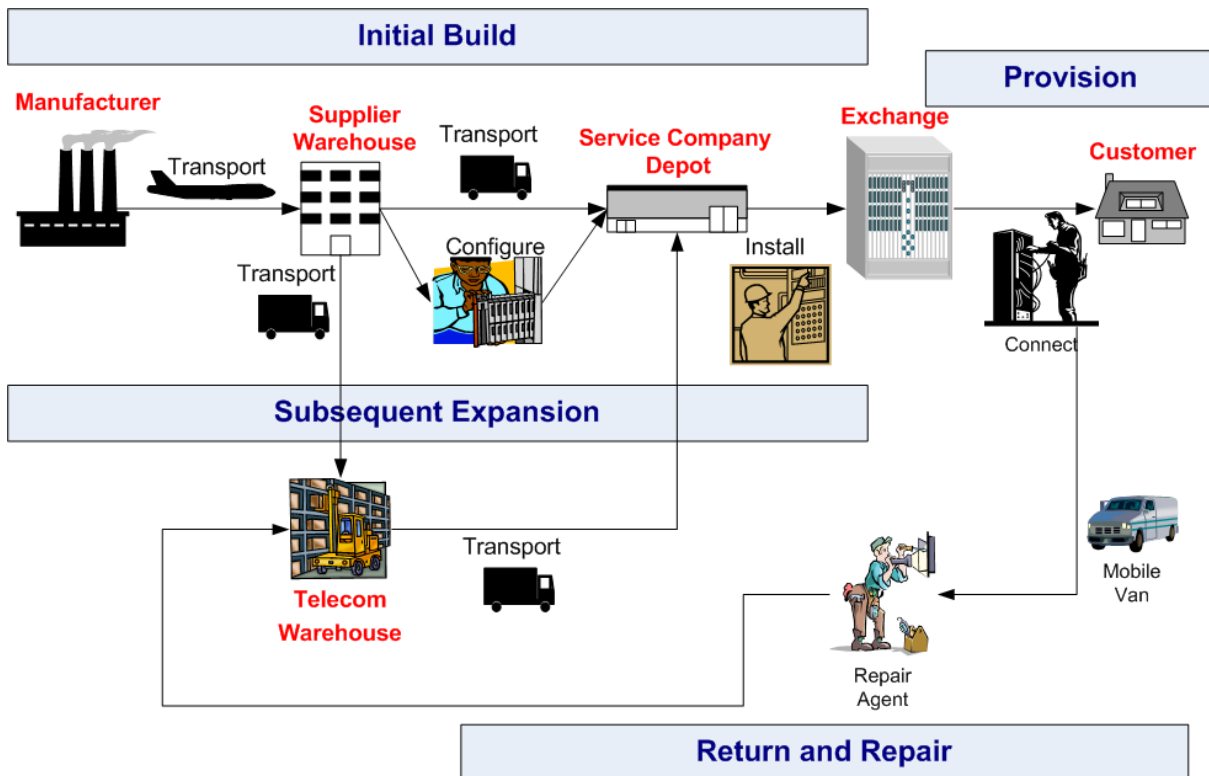


Source: Telecom New Zealand

5.7.2 Material Flow

The flow of goods for the fixed network supply chain at Telecom comprises of four main processes as represented in Figure 5.15 below.

The initial build, subsequent expansion and repair activities are not directly related to a customer order whereas provisioning is about “connecting” the customer.

Figure 5.15: Fixed Network Process Overview

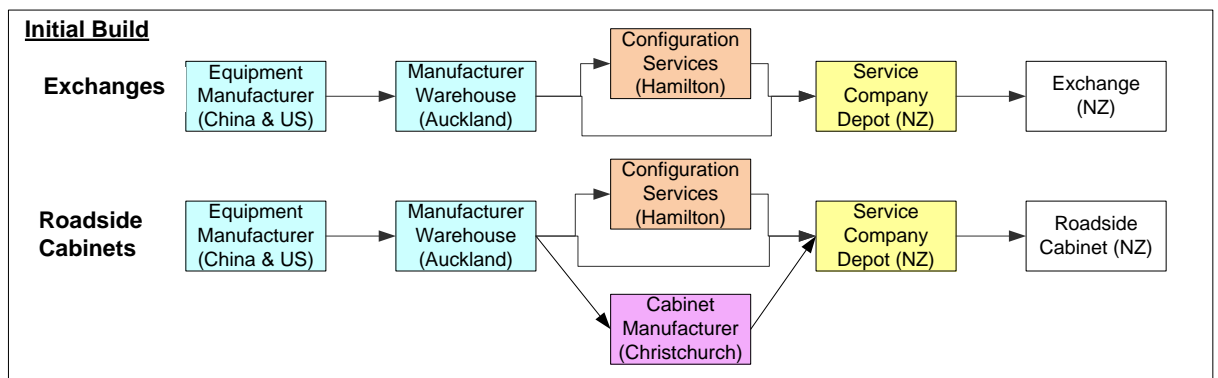
The processes are mapped in detail. The purpose of this is to provide a logical map of the flow of goods in the supply chain. There are four main processes:

1. **Initial Build.** This process is used to commission the main equipment at the exchange or cabinet. This is done based on a forecast. This equipment (comprising of the rack and a set of cards) carries the necessary infrastructure to support a limited number of customers, depending on the equipment type. Once this threshold is reached, another piece of equipment is required to support the next lot of customers.

The supply chain in this instance comprises of the goods manufacture at the supplier OEM in China or US, sending the finished goods via air freight to the supplier's warehouse in Auckland, NZ. The equipment remains there until it is time to despatch. Some cards are sent via a configuration specialist supplier for pre-staging; the rest of the equipment is sent to the service contractor's depot. It is stored there until it is taken up for installation at the exchange.

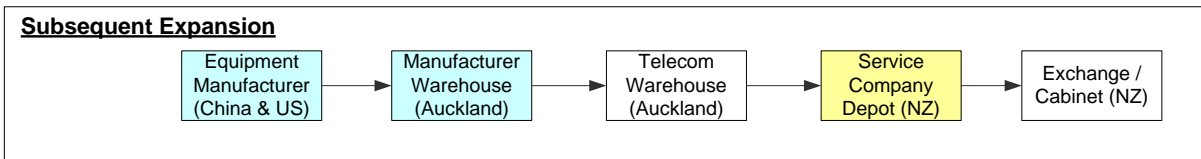
Equipment may also be installed in a roadside cabinet. In this instance, the cabinets are manufactured and available at Christchurch. The racks that come from the equipment manufacturer's warehouse in Auckland are sent to Christchurch for integrating into the cabinet whereas other cards are sent to the service contractor's depot. They are then sent to the service company depot to await installation. Figure 5.16 illustrates this.

Figure 5.16: Material Flow (Initial Build)



2. Subsequent Expansion. This is done by means of a “line card”. Typically a “line card” has 48 ports and every broadband user is connected to a port of one of these cards. As part of the initial build, one line is installed in the equipment. Once the threshold of users on the card is reached, another card must be installed to connect more users. The ordering is in bulk and based on a joint demand forecast between Telecom and the supplier.

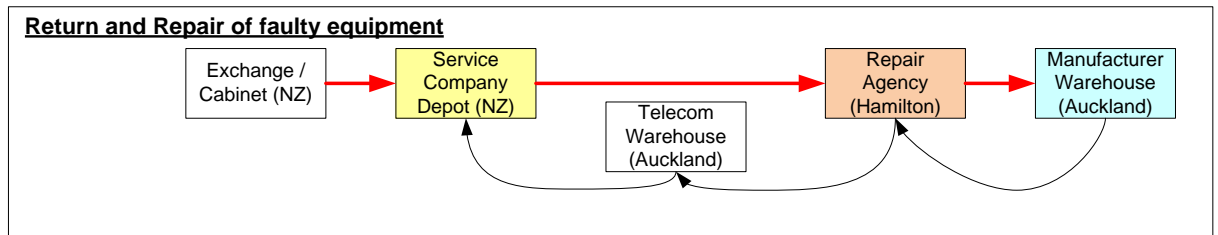
The supply chain in this instance comprises of the goods manufacture at the supplier OEM in China or US, sending the finished goods via air freight to the supplier's warehouse in Auckland, NZ and then to Telecom's warehouse in Auckland. The service contractor draws down the stock of cards as required. The cards then sit there until it is installed either in the exchange or in a roadside cabinet. Figure 5.17 illustrates this.

Figure 5.17: Material Flow (Subsequent Expansion)

3. Provisioning. This is the ultimate customer facing activity and is performed on receiving a customer order to set them up with a service.
The supply chain in this instance is different. DTE (Data Terminating Equipment) is purchased from the overseas supplier and held in the warehouse. As and when a customer order is received (either for a new connection or fixing a fault), the equipment is installed at the customer’s premises and also “hooked up” to the port on the line card in the exchange or the cabinet. It must be noted that these processes do not occur in the SAP system but are managed by a different Work Management system. This process is not mapped and is out of scope for this study.

4. Return and Repair of faulty equipment (Figure 5.18). Whenever a card or rack is faulty, the service contractor replaces the faulty item with a spare that is in their depot. (Service contractors hold a number of spares at their depot based on a forecast). The faulty cards are kept in their depot. They then fill out a return order and send the items to the repair agent in located in Hamilton. The repair agent will attempt to repair it. If it cannot be repaired, it must be replaced and they then return the faulty item to the equipment supplier. They also hold a stock of good items. The repaired or replaced items are then sent to Telecom’s central warehouse in Auckland where they are held as spares. When the stock of spares at the service company falls below a maintained threshold, it is replenished from the central warehouse in Auckland.

Figure 5.18: Material Flow (Return and Repair)



5.7.3 Thread Diagram

Based on the above processes, a SCOR thread diagram has been developed for the current state of the build, expansion and provisioning processes. It must be noted that there are other processes e.g. return of fault goods, repairs etc. but they have not been considered.

The SCOR Level 2 processes are shown in Table 5.19. Refer to Figure 3.8 for the SCOR model that has been amended for Telecom for a description of the terms.

Table 5.19: SCOR Level 2 Processes

Plan		Source	
Process	Description	Process	Description
P1	Plan Supply Chain	S1	Source Stocked Product
P2	Plan Source	S2	Source Make to Order Product
P3	Plan Make	S3	Source Engineer to Order Product
P4	Plan Deliver	SS2	Source MTO Services
		SS3	Source ETO Services

Make		Deliver	
M1	Make to Stock	D1	Deliver Stocked Product
M2	Make to Order	D2	Deliver Make to Order Product
M3	Engineer to Order	D3	Deliver Engineer to Order Product
MS2	Make to Order Services	DS2	Deliver MTO Services
MS3	Engineer to Order Services	DS3	Deliver ETO Services
Return			
SR1	Source Return Defective Product	DR1	Deliver Return Defective Product
SR2	Source Return MRO Product	DR2	Deliver Return MRO Product
SR3	Source Return Excess Product	DR3	Deliver Return Excess Product
SSR1	Return Defective Service	DSR1	Return Defective Service

Based on the above processes, a SCOR thread diagram (Figure 5.19) has been developed for the current state of the build, expansion and provisioning processes. Processes like return of fault goods and repairs have not been considered.

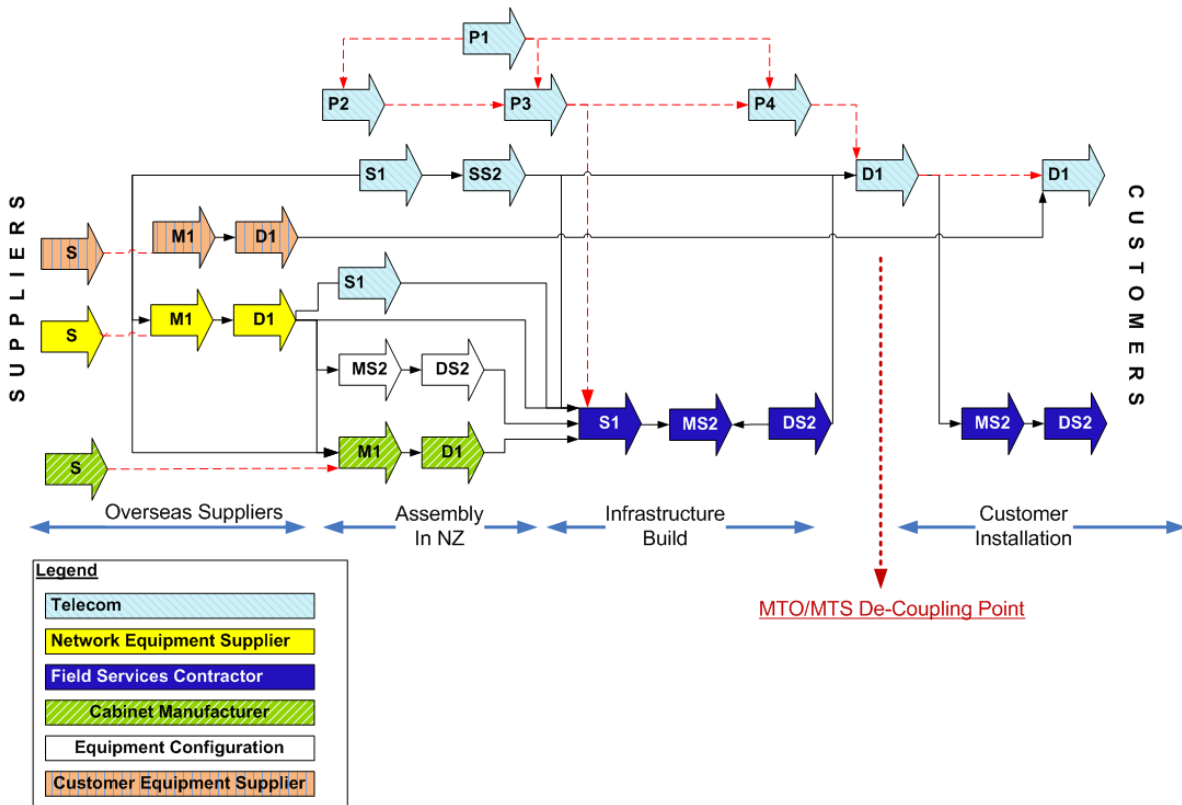
The supply chain structure is as follows

- Network Hardware (Yellow) is ordered for deployment into exchanges (as a standalone equipment) or roadside cabinets (into which they are integrated). They are shipped from the supplier's overseas facilities and received at the supplier warehouse in Auckland from where they are delivered to one or more of the following locations
 - Racks for roadside cabinets are sent to Cabinet Manufacturer for integration (Green) into the cabinets. After this, they are sent to the service contractor (Dark Blue).
 - Some cards are sent to the supplier's specialist services center in Hamilton for configuration (White) as per Telecom network parameters. After configuration they are sent to the service contractor (Dark Blue).
 - Racks for the exchange and the rest of the equipment are sent directly to the service contractor (Dark Blue).
 - Extra cards required for subsequent expansion are sent to a central Telecom warehouse in Auckland to be stored (Light Blue). When needed, they are sent to the service contractor (Dark Blue).
- All equipment is kept at the service contractor's depot. When the service order for the build is received, all the required equipment is taken to the site (exchange or roadside) for installation and commissioning (Dark Blue). There are over 30 service contractor depots.
- From time to time capacity must be augmented and service contractors request the extra expansion cards from the Auckland warehouse (Light Blue) and install them in exchanges or cabinets (Dark Blue)
- Customer Equipment (e.g. Set-top boxes, ADSL modems) are ordered and stored at a service contractor facility (Brown).
- When a customer order is received (provisioning), the service contractor installs the set-top box and cables at the customer premises and hooks it up with the equipment installed at an exchange or roadside cabinet.

The diagram also shows the MTO/MTS de-coupling point. The infrastructure preparation at the exchange or cabinet occurs based on a rough forecast and is

independent of customer orders. This is where the MTS (Make to Stock) boundary ends. Delivery to the end customer requires a small connection with the infrastructure and is performed on receipt of the customer order. This is where the MTO (Make to Order) process begins.

Figure 5.19: SCOR Thread Diagram (AS-IS)



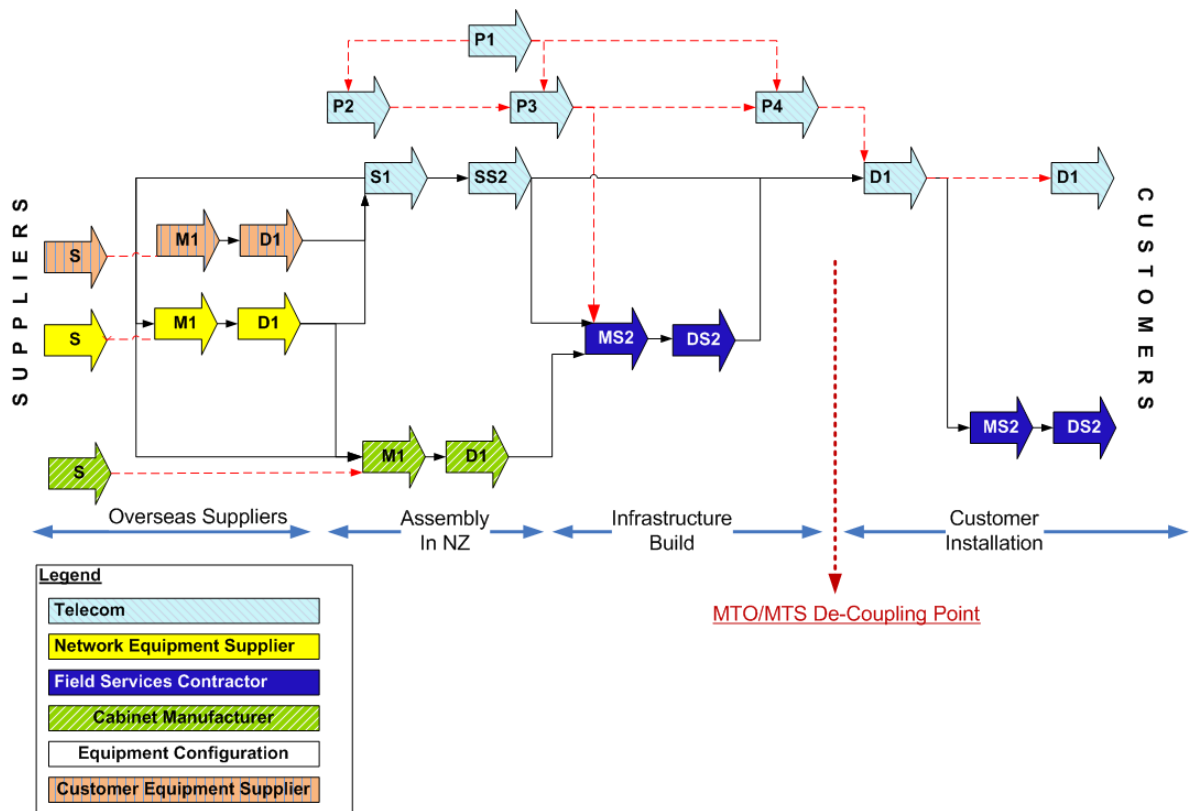
The AS-IS thread diagram shows that the field service contractor is the central area where most of the activities ultimately converge. It is evident from the cash to cash cycle time (Section 5.7.5) and the installation times (Figure 5.22) that significant inventory is being accumulated at the service contractor site. To gain efficiencies in the supply chain a number of things could be considered (TO-BE - Figure 5.20).

- There must be good communication through the supply chain in terms of planning and information sharing.
- Currently large network equipments are being air-freighted from the supplier's overseas manufacturing facilities. Not only does this result in extra logistics costs, but the frequent off-loading at various airports result in

damages which come to light only past the warranty period. These damages are then absorbed as part of the maintenance operational expenses. These can be shipped by sea freight to New Zealand. While this would result in longer transport times, it can be offset by the use of a good forecast and creating purchase orders in advance.

- Currently network equipment is being stored at 30 different service contractor depots and awaiting installation, resulting in excess inventories. Storage at a central warehouse or a few regional warehouses could be considered to reduce inventories. Just before installation, the service contractor could request the equipment. As these are strategic supplies, Telecom could further take advantage of the supplier relationship and come to a VMI (Vendor Managed Inventory) arrangement whereby the supplier holds the equipment until they are needed.
- Configuration of the network cards could be done before shipping by the suppliers overseas facilities, leading to cost and time reductions.

Figure 5.20: SCOR Thread Diagram (TO-BE)



5.7.4 Supply Chain Performance

The Fixed Network Supply Chain consists of the following entities

- Manufacturer of the network hardware
- Manufacturer of the roadside cabinet
- The manufacturers warehouse
- Service company depots (stocking locations). This is the common point at which all inventory is collected and then transported to the exchange or cabinet for installation and commissioning. There are about 30 such depots
- Exchanges (where the network hardware is installed) / Roadside locations- There are a number of these locations.
- Customer (where the network terminating unit is installed). This is a large customer base

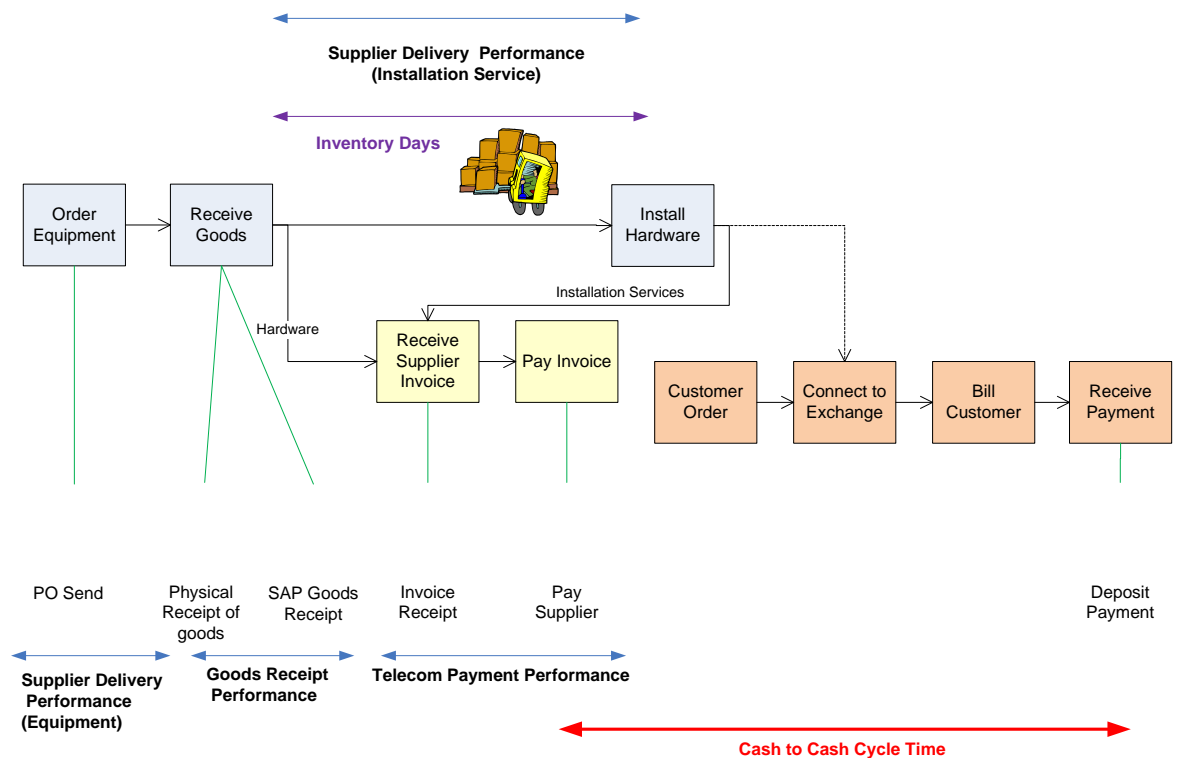
The focus of this report has been on the purchasing aspects of the broadband supply chain. Not all performance metrics described in section 3.3.3 have been calculated.

This study has focussed on the following metrics only.

- Delivery Performance for Equipment Supply – Fixed Network Hardware.
- Delivery Performance for Installation Services
- Inventory Days of Supply
- Cash to Cash Cycle Time

They are depicted in Figure 5.21.

Figure 5.21: Performance metrics measured



Delivery Performance - Fixed Network Hardware Supply

Typically a purchase order is created to purchase these items from the hardware supplier. As described earlier, every PO must have a material group which helps in classifying the item. The delivery statistics is examined by material group for the Network Hardware category and is shown below in Table 5.20.

Table 5.20: Fixed Network Delivery Statistics

Category 2	Material Group	No. of PO Items	Max Days	Average Days	Min Days
Batteries & UPS	1	1,395	258	44	1
Batteries & UPS	2	1,305	306	56	1
Cabinets & Frames	1	2,404	384	106	1
Cabinets & Frames	2	112	120	61	3
Cabinets & Frames	3	110	23	12	3
Cables	1	495	224	23	1

Category 2	Material Group	No. of PO Items	Max Days	Average Days	Min Days
Cables	2	3,127	364	24	1
Cables	3	49	35	7	1
Cables	4	371	324	55	1
Cables	5	225	195	13	1
Cables	6	164	112	7	1
Fixed Network	1	241	315	26	1
Fixed Network	2	142	306	72	22
Fixed Network	3	2	69	69	69
Fixed Network	4	1	4	4	4
Fixed Network	5	2,379	456	35	1
Fixed Network	6	2	147	107	67
Fixed Network	7	181	210	57	1
Fixed Network	8	182	455	52	1
Fixed Network	9	35	425	100	10
Fixed Network	10	172	216	90	8
Fixed Network	11	814	251	69	2
Fixed Network	12	2,712	391	71	2
Fixed Network	13	92	142	20	4
Fixed Network	14	2	44	30	15
Fixed Network	14	267	323	88	7
Fixed Network	15	1,427	221	67	1
Fixed Network	16	52	193	106	1
Fixed Network	17	1	18	18	18
Fixed Network	18	1	30	30	30
Fixed Network	19	8	139	54	26
Fixed Network	20	107	192	68	5
Fixed Network	21	21	97	25	9
Fixed Network	22	128	347	64	4
Fixed Network	23	126	252	67	1
Fixed Network	24	1,752	110	13	1
Fixed Network	25	1	14	14	14

Category 2	Material Group	No. of PO Items	Max Days	Average Days	Min Days
Fixed Network	26	33	445	119	8
Fixed Network	27	3	6	6	6
Fixed Network	28	18	23	13	5
Fixed Network	29	282	203	40	2
Fixed Network	30	8	110	74	43
Fixed Network	31	1			
Fixed Network	32	674	475	94	1
Fixed Network	33	366	331	127	16
Fixed Network	34	321	210	107	17
Fixed Network	35	19	247	136	19
Fixed Network	36	301	108	35	3
Fixed Network	37	45	134	52	1
Fixed Network	38	1,345	412	32	1
Fixed Network	39	724	428	140	13

In particular, for the equipment that is being examined in detail (highlighted in colour), the delivery performance is far from satisfactory.

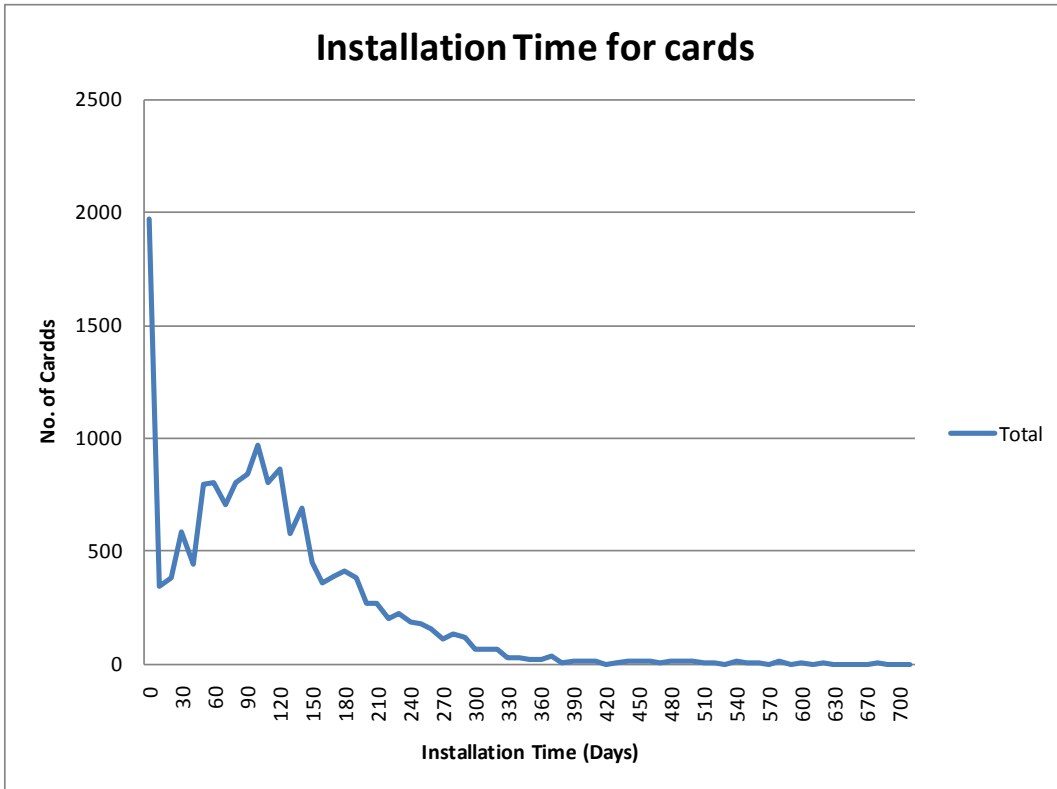
Delivery Performance – Installation Services

The network hardware must be installed by a qualified technician in the exchange or a cabinet. These build jobs are handled via a work management system (not SAP) and there is a large number of such jobs. From a purchasing perspective, a monthly bulk Purchase Order is created in SAP to cater for all build activities performed by a service contractor. Thus delivery performance information could not be extracted from the SAP purchasing system. However, it was possible to extract this data from the Plant Maintenance System.

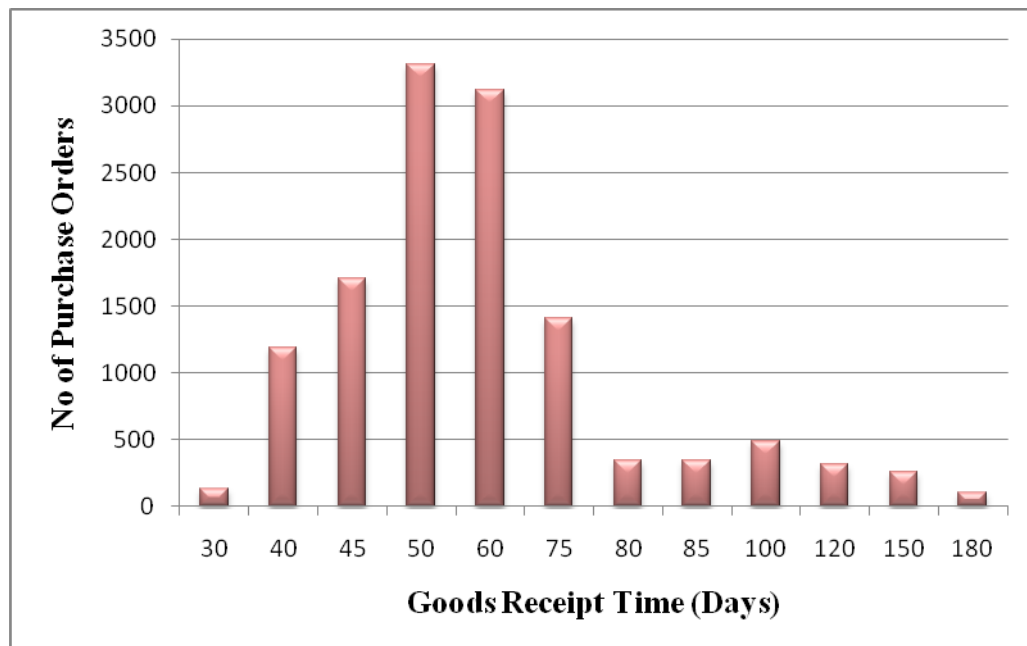
The delivery performance for installation services is calculated based on the date from which the hardware was received by the service contractor and the date on

which the item was installed. Figure 5.22 shows the installation times for network cards.

Figure 5.22: Installation Times (No. of Cards)



It is evident based on the data that the average installation times vary from 60 to 180 days. If we use 90 days as a mean installation time then we can conclude that on an average there is 90 days worth of inventory in the service company depot.

Figure 5.23: Goods Receipt Delay

As mentioned earlier, the delivery performance is calculated based on the goods receipt time. Further investigation on the delivery performance reveals that the delay in goods receiving may also skew the supplier performance metrics (See Figure 5.23)

5.7.5 Cash to Cash Cycle Time

As discussed in section 3.3.3, cash to cash cycle time is calculated as

Inventory days of supply (Time taken to convert raw materials to finished goods)
+ PLUS
Days sales outstanding (No. of days from product sale to receipt of cash from customer)
- MINUS
Days Payables outstanding (Time taken to pay suppliers for purchases)

Based on the data gathered above, the cash to cash cycle time can be calculated as follows

- Inventory Days of Supply. We can assume a value of 90 days.
- Days Sales Outstanding. We can assume a value of 45 days??
- Days Payable Outstanding. We can assume a value of 45 days

Based on the formula, the Cash to Cash cycle time is 90 days.

How can this be reduced? There are many ways this can be done, the most obvious being the three variables that make the Cash to Cash equation. Therefore one or all of the following approaches can be pursued.

- Reduce Inventory. This is where value can be obtained first. Inventory in this instance translates to money lying around in the service contractor's warehouse and therefore not available for any other use.
- Reduce Accounts Receivables. As this is related to sales, this area is beyond the scope of this research. However there are many ways to reduce the days to receivables. Examples include reduction of collection cycle, tighter credit policy, reducing the terms of credit, shortening the invoicing process, reducing billing errors, and reviewing the accounting process periodically.
- Increase Accounts Payables. The most significant advantages would be gained by negotiating favourable payment terms and prompt payment discounts.

A number of techniques could be used to reduce overall cash to cash cycle time. They are

- Improve forecast accuracy. A proper forecast will result in orders being placed closer to the time of need and thus eliminate the need to carry inventory. This should be based on the service contractor install timetables.
- Increase build efficiency. Improving the installation times will lead to reduced inventory as well as faster realisation of sales.

- Increase supply chain turns or Just-In-Time. Purchasing the network hardware more often and in smaller quantities would increase cash flow and reduce the carrying cost of inventory. However, this may increase the unit cost of acquisition, but this can be counterbalanced by techniques like e-procurement.
- Reduce safety stock. Improvements in the first three variables will reduce the need to maintain safety stocks. Aim to eliminate the need for safety stocks.
- Streamline logistics. Currently the goods are air-freighted from China. Providing the supplier with a proper forecast will eliminate the need for air-freighting and allow for transportation by ship. Not only will this reduce inventory but it will also reduce shipping costs and the total cost of the product.
- Manage delivery variance. Monitor delivery performance closely and work with the supplier to minimise variance. This requires providing them with a robust forecast.
- Try out Vendor Managed Inventory (VMI). In situations where the consumption is high but predictable and the buyer is able to provide the consumption history to the supplier, the supplier may be entrusted with managing the inventory. This allows the supplier to have a greater degree of flexibility in planning deliveries, freight and response times. This can also take the form of consignment stocks wherein the stock remains the property of the supplier until it is used
- Increasing automation as described in the E-Procurement section
- Standardising and streamlining the purchasing process by removing inefficiencies internally as well as at the supplier end and reducing errors in processes.

5.7.6 Supply Chain Maturity

An attempt is made to assess the supply chain maturity as described by Lockamy & McCormack (2004a) in Section 3.2.4. Based on their definition, the supply chain maturity can be rated just over Stage 2 but not quite a Stage 3. The reasons for this are as follows

- Stage 2 is where basic SCM processes are defined and documented but the activities and organisation continues to remain traditional.
- Stage 3 is where there is external integration and co-operation between departments, vendors and customers.

Telecom has established links with key suppliers however not all key SCM processes are clearly defined and measured. Hence it is ranked at just below Stage 3.

Chapter 6. Conclusion

6.1 Introduction

The objective of this study as stated in Chapter 1 is to identify avenues for efficiency and cost reduction in the supply chain from a procurement perspective for a New Zealand based telecommunications organisation.

A number of areas were investigated during the study and the outcome has been discussed in Chapter 5. In this chapter the objectives of the study are assessed against the findings and discussions and then the conclusions are then presented. Lastly, the limitations of the study and recommendations for future research are presented.

6.2 Overall Objective

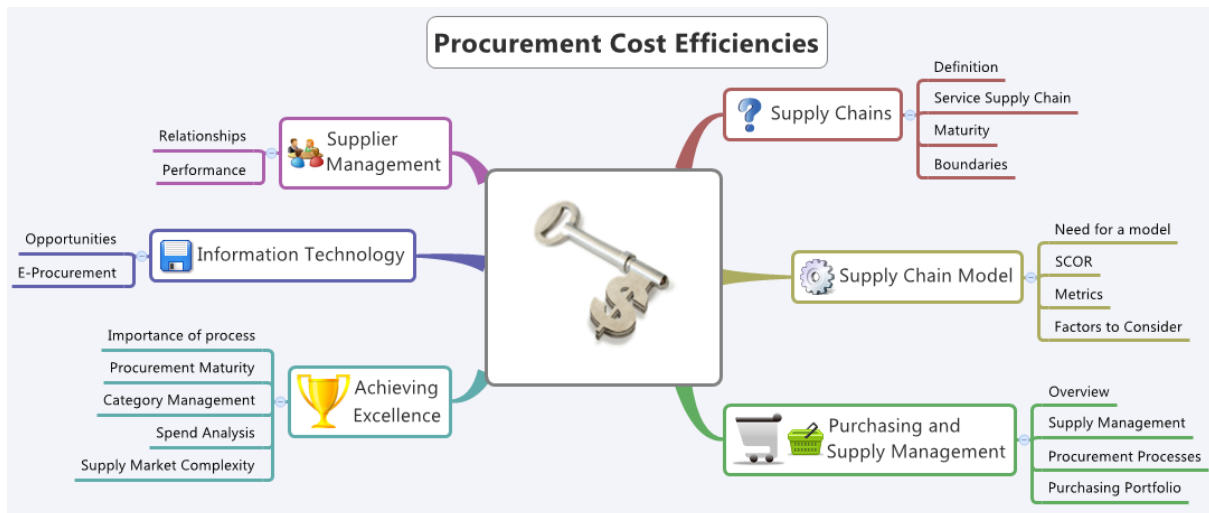
The prime objective of this study was to identify avenues for efficiency and cost reduction in the supply chain from a procurement perspective for a New Zealand based telecommunications organisation.

For achieving this, the following supporting objectives were proposed.

- Review the current procurement processes and identify avenues for efficiency gains
- Identify spend patterns to conduct effective supplier base analysis
- Explore how procurement performance is measured
- Leverage use of Information Technology to reduce costs
- Model and analyse the supply chain to assess the current state of performance. The fixed networks business unit was the focus for this exercise.

This study explored a number of areas as shown in Figure 6.1 below.

Figure 6.1: Areas covered by study



6.3 Objective 1 – Procurement Process Review

The first objective was to review the current procurement processes and identify avenues for efficiency gains.

To meet this objective, the key procurement processes, namely, Forecast, Source, Purchase, Pay and Review was reviewed. For each process area, the current state was studied and shortcomings (if any) were identified. A summary of the findings is given below.

- **Forecast.** The review in this area revealed that
 - There is little evidence of a proper forecasting process that would help procurement personnel to plan purchases.
 - The absence of a forecast leads to high inventories, higher logistics costs and increases the risk of obsolescence.
- **Source.** The review in this area revealed that
 - There is no formal well-defined sourcing process that spans requirements gathering, supplier selection and contract management.

- Sourcing is performed mainly for large capital project related purchases. For other purchases, it is non-existent or varies significantly between business units. The involvement of the T&SS sourcing team is restricted.
- There is no single repository for supplier contracts. In most cases, preferred supplier arrangements or visibility of contracted prices is not available thus leading to maverick spending. A single contract repository can easily be implemented in the current SAP system.
- **Purchase.** The findings in this area are as follows:
 - There are a number of different purchasing scenarios, however there is no clear documentation and guidance on their usage.
 - Process compliance is a key issue and is the root cause of most of the problems.
 - Most purchases do not have a material or SKU number and as a result important history information for repeatedly purchased items is lost.
- **Pay.** The key findings in this area are
 - All supplier invoices sent are received and processed by the Telecom AP (Accounts Payable) team.
 - The invoices are either sent electronically or are scanned into the system.
 - A number of invoices are parked or blocked and cannot be processed on time. This is mainly because of the absence of a corresponding PO or a mismatch between the invoice and PO in terms of quantity and price. The root cause is process compliance.
 - Using E-Procurement, ERS (Evaluated Receipt Settlement) and upload invoices would reduce the need for manually handling invoices.
- **Review.** This is an important but often neglected step in the purchasing cycle.
 - There is no formal process for reviewing supplier performance or assessing the performance after contract completion.
 - Purchasing spend must be analysed on a regular basis to maintain control over the suppliers as well as be able to respond to market fluctuations. Using

material numbers for frequently purchased items would make the analysis more accurate.

- Having the information in a single repository (e.g. the current SAP system) would make this task easier.

An assessment of the strategic procurement process maturity as defined by Cousins et al (2008) put it at very close to a Stage 2 – Independent. Establishing an integrated S&OP process, clear performance metrics and ensuring process compliance would improve this rating.

6.4 Objective 2 – Spend Patterns for Supplier Base Analysis

The success of any supply management program is largely dependent upon the ability to access, organise and analyse spend data. However this analysis is difficult to achieve in most organisations and Telecom NZ was no exception.

One of the first tasks was to implement category management. This required designing the category architecture, setting up an organisation structure aligned to the categories and analysing the purchasing spend by supplier by category. The analysis revealed the following information:

- The purchasing spend is 54% of the revenue. Most of it is in New Zealand dollars and covers 3,772 active vendors. 80% of this spend is with only 81 vendors. Over a thousand suppliers got less than NZ \$5,000. Thus there is significant opportunity to rationalise the supplier base.
- A number of duplicate vendor records exist thus reducing opportunities for volume negotiation.
- Spend analysis by categories revealed that the services category (both Professional and Field Services) appear to have the highest spend. Facilities Management has a much higher ratio of supplier count to spend. Thus spend

analysis by category can be used to identify categories where maximum opportunities exist for supply base rationalisation.

- The Kraljic portfolio analysis showed that strategic products and services represent a significant value (about 50%) with about 133 suppliers. At the other end is the transactional quadrant where 8% of the spend occurs with 2,966 suppliers making this the target for supplier base reduction.

Thus the spend analysis reports provided an insight into Telecom's spend profile and could be used to quickly narrow down the areas for targeting supply base rationalisation.

Due to the poor quality of the base purchasing transaction data, significant effort had to be expended into cleaning the data to enable classification into categories. This was a one-off effort, however regular reporting entails a more rigorous approach to correct data entry in the base transaction. As part of this project, process and system changes were also implemented to validate and trap missing or inaccurate data during purchase order entry.

6.5 Objective 3 – Performance Measurement

Goldratt (1992) very correctly remarked "Tell me how you measure me and I will tell you how I will behave". Performance measurements are thus a key aspect to achieving procurement efficiencies. It is important to establish the key performance metrics (KPI's) and a very clear process for measuring it.

There was no evidence of reporting on procurement metrics. This study attempted to measure some metrics for which the data could be made available. The following are some of the conclusions:

- A number of metrics could not be measured because the data did not exist or was not easily available. Also the accuracy of the existing data was highly suspect.
- The following aspects of performance were measured in detail.

- **Supplier delivery.** This was measured at a total level for all purchases. For fixed network equipment, performance of equipment delivery and installation services was measured to a finer level of granularity. The results show that delivery performance is very poor for a number of suppliers. Corrective steps need to be taken to measure and monitor it.
- **Payment Performance.** A number of purchase orders are created after the invoice is received. Invoices are received and processed by the Accounts Payable team. Payment is to be made on the due date which is specified by the payment terms on the invoice. The analysis showed that over 62% of the invoices were paid early thus resulting in a significant loss of interest. Management of invoices and payment would contribute to improved cost savings.
- Maintenance of Prompt payment discounts could be effectively used with some suppliers.
- **Hidden Costs.** The following aspects of performance were not being formally measured as the information cannot be easily obtained from the current processes. It is recommended that this be done to get an immediate visibility of hidden costs
 - Supplier quality and related measures for MTBF (Mean Time Between Failures) and MTTR (Mean Time To Repair).
 - Equipment Out of box failures.
 - Contract adherence and maverick spend – where items are purchased either from another supplier or the contracted prices and volumes are not met).
 - Sourcing Performance.
 - Order and Invoice Accuracy is important to monitor compliance.

6.6 Objective 4 – Leverage IT for cost reduction

IT plays an important role at Telecom for procurement. SAP is the main system that is used and contains the core ‘purchase’ and ‘pay’ documents like purchase orders

and supplier invoices. Other aspects of procurement like sourcing, review and forecasting are either not in any system or are scattered across a number of systems.

An attempt was made to assess the IT systems maturity as described by Heinrich and Simchi-Levi (2005). From a supply chain perspective, the overall IT systems maturity can be said to be 'Immature'. This is largely due to the fact that the business processes were disconnected and the data sharing across the supply chain is minimal.

Opportunities for leveraging the use of Information Technology exists in two main areas

- **Process Re-engineering.** The analysis showed that Telecom could exploit a number of purchasing processes to manage different business scenarios to advantage. Examples include use of the special SRM processes to manage services procurement, ERS (Evaluated Receipt Settlement) to avoid invoice creation and recurring payments to automate regularly created payments and reduce manual intervention. This study has provided some clear examples of the process time reductions.
- **Electronic Procurement.** Currently about 47% of the purchase orders and 40% of the invoices being transmitted electronically. However these are targeted at suppliers with high volumes. However a number of other technologies could be used for low volume suppliers to drive down processing costs or with bottleneck suppliers to ensure supply.

Significant opportunities exist within Telecom to leverage Information Technology mainly in the areas of e-procurement solutions and process redesign. When implemented, it would complement the category management initiative in a number of ways like speeding up invoice processing to avail of prompt payment discounts, ensuring use of preferred suppliers and contracted prices, reducing the number of blocked and parked invoices etc.

The findings and recommendations have been discussed in detail in section 5.6.

6.7 Objective 5 – Supply Chain Modelling and Analysis

Most of the previous sections focussed on the procurement aspects of Telecom. In this section, an attempt was made to model and analyse the wider supply chain. The SCOR model developed by the Supply Chain Council was used to model the fixed networks business unit.

- The SCOR thread diagram and material flow analysis showed that the initial build is a very complex process. It also showed that the field service contractors are the central point of contention. The impact of the network configuration on the logistics costs was clearly evident. The installation and goods delivery performance analysis revealed that a lack of proper forecasting and supplier performance management had a significant impact on inventories and logistics costs. It also leads to a high number of out of box failures.
- The SCOR standard cash to cash cycle time was calculated to be about 90 days. This is very high as compared to the 30 days of the “best-in-class” company. Reducing Inventory is one of the key ways to improve this performance.

6.8 Limitations

This was largely an exploratory study and focussed on purchasing and supply management practices at Telecom New Zealand.

Whilst it covered a breadth of areas, there have been a few restrictions.

- Firstly this study has been limited to only one telecommunication organisation in New Zealand (albeit a large one). There are a couple of other telcos in New Zealand and therefore it may not be representative of the industry and cannot be generalized.
- Only some aspects of cost reduction opportunities are considered. A number of areas like personnel skills, import costs, foreign currency analysis have not been taken into account.

- The supply chain analysis only formed a small part of it. It only considered the fixed networks business from a procurement perspective and did not consider other processes like sales and reverse logistics. It also did not cover in detail the processes at the Retail business unit.
- Lack of time and budget also contributed to some of the limitations.
- The interviews in this study were conducted with only a few people from each stream and as such may not be representative of the entire organisation.

6.9 Future Research

The study explored a number of ways to gain insight into procurement costs and investigated a number of opportunities to reducing costs and improving procurement efficiencies.

In order to get a better handle on procurement costs, many researchers recommend performing a detailed cost analysis. Zsidisin and Ellram (2003) describe three strategic cost management tools to manage inbound supply costs. They are

- Total cost of ownership
- Supplier cost structure analysis and
- Target costing

Whilst these tools do require supplier cooperation, they also provide the buyer with an insight into the best methods for taking costs out of products and services without resorting to supplier profit reduction. Purchases from suppliers contribute to 60-70% of the cost of sales for many manufacturing firms and every dollar saved directly impacts profitability. Hence the ability to manage cost is critical for corporate success.

Out of these, Ellram (1995) says that Total Cost of Ownership (TCO) contributes to a deeper understanding of total supply chain costs. She describes two approaches, a value-based and a dollar-based approach to determine TCO. The dollar-based approach relies on using actual cost data for each of the relevant TCO activities,

whereas the value-based combines dollar data with other performance data to arrive at weightings. The dollar-based approach could be extended to use the activity level to allocate costs. This is the principle of Activity based costing (ABC).

Lambert and Pohlen (2001) state that three components of total cost must be considered to cover the product/service lifecycle. They are acquisition costs, ownership costs and post-ownership Costs.

Ellram and Siferd (1998) researched further into use of TCO in strategic cost management decisions using case studies from a number of firms including a telecommunications firm. They argue that cost considerations must include costs both external and internal to an organisation to qualify as a strategic tool and recommend the use of TCO to blend in value chain analysis, strategic positioning analysis and cost driver analysis.

Based on the findings above, it is recommended that TCO analysis be performed to obtain a good understanding of the costs and to further identify opportunities for cost reduction.

References

- Aberdeen (2004) 'Best Practices in Spending Analysis' *The Aberdeen Group*, September 2004, Available: <http://www.aberdeen.com>
- Anon (2010a), 'Fixed-line telecommunication', Wikinvest concepts, [http://www.wikinvest.com/concept/Fixed-line telecommunication](http://www.wikinvest.com/concept/Fixed-line_telecommunication), downloaded 22/11/2010
- Asokan, S. (2008), 'Global Supply Chain Management- Role of emerging economies: An Airtel Perspective', www.iimb.ernet.in/~review/imrc2008/Resources/Asokan.pdf
- Auramo J., Kauremaa J., Tanskanen K. (2006), 'Benefits of IT in supply chain management: an exploratory study of progressive companies', *International Journal of Physical Distribution & Logistics*, Vol. 35, No. 2 (2005)
- Axelsson, B. & Wynstra, F. (2002), 'Buying Business Services', *John Wiley & Sons*
- Ballou, R. H. (2007) 'The evolution and future of logistics and supply chain management', *European Business Review*, Vol 19, No 4, 2007
- Basnet, C., Childerhouse, P., Foulds, L.R., Martin, V. (2006), 'Sustaining supply chain management in New Zealand', *International Journal of Logistics Systems and Management*, Vol 2, No.3, 2006
- Basnet, C., Corner, J., Wisner J., Tan K-C (2003), 'Benchmarking supply chain management practice in New Zealand', *Supply Chain Management An International Journal*, Vol 8, No. 1, 2003
- Benton W.C. Jr (2007). 'Purchasing and supply management' *McGraw-Hill, Irwin*.
- Bolstorff, P., Rosenbaum, R. (2007) 'Supply Chain Excellence – A handbook for dramatic improvement using the SCOR Model', *AMACOM, USA*
- Bonoma, T.V. (1985) 'Case Research in Marketing: Opportunities, Problems, and a Process', *Journal of Marketing Research*, XXII, May, pp. 199-208

References

- Buckingham, C. (1993) 'Category Management in Europe: From Concept to Reality', *European Retail Digest*, (1), 1-5
- Caniels, C.J.M., Gelderman, C.J. (2005), 'Purchasing Strategies in the Kraljic Matrix – A power and dependence perspective', *Journal of Purchasing & Supply Management*; 11 2005; 141-155
- Carr A & Kaynak H (2007) 'Communication Methods, information sharing, supplier development and performance', *International Journal of Operations & Production Management*, Vol 27, No. 4, 2007
- Cavinato, J.L., Kauffman, R.G., (2000) 'The Purchasing Handbook – A guide for the Purchasing and Supply ', 6th edition, *McGraw-Hill*
- Chaffey D. (2009) 'E-Business and E-Commerce Management – Strategy, Implementation and Practice' 4th edition, *Prentice Hall*
- Chopra S, Meindl P (2007) 'Supply Chain Management – Strategy, Planning and Operation' 3rd edition, *Prentice Hall*
- Christopher, M. (2005), 'Logistics and Supply Chain Management – Creating Value Added Networks', 3rd edition; *Financial Times Prentice Hall*
- CIPS (2010), 'The Chartered Institute of Purchasing and Supply Management – Resources', Available <http://www.cips.org/en/resources/tools/glossaryofterms>, accessed 24/05/2010
- CIPS (2010a), 'The Chartered Institute of Purchasing and Supply Management – Knowledge Bytes', Available http://cips.studyserve.com/Courseware/CIPS_Content/KnowledgeBytes
- Clough, P. & Nutbrown, C. (2002) 'A Students guide to Methodology', *Sage Publications*
- Cohen S, Roussel J (2004) 'Strategic Supply Chain Management', *McGraw-Hill*

References

- Cook, M. and Hagey R. (2003) 'Why companies flunk supply-chain 101', *Journal of Business Strategy*, Vol. 24, No. 4 (2003)
- Cousins, P., Lamming, R., Lawson, B. and Squire, B. (2008) 'Strategic Supply management – Principles, Theories and Practice'. *FT Press, Prentice Hall*
- Cresswell, J.W. (1994) 'Research Design: Qualitative and Quantitative Approaches', *Thousand Oaks: Sage*.
- CSCMP (2010), Council of Supply Chain Management Professionals, <http://cscmp.org/aboutcscmp/definitions.asp>, accessed February 2010
- Data Monitor (2008), Industry Profiles sourced at www.datamonitor.com
- Datamonitor (2010), 'Telecom New Zealand Company Overview – Published September 2010', *Downloaded from EBSCO on 2/11/2010*
- Eisenhardt, K.M. (1989) 'Building Research Theories from Case Study Research', *Academy of Management Review*, 14 (4), pp. 532-50
- Ellram, L.M. (1995), 'Total Cost of Ownership – An analysis approach for purchasing', *International Journal of Physical Distribution & Logistics*, Vol. 25, No. 8 (1995)
- Ellram, L.M. Tate, W.L., Billington, C. (2004), 'Understanding and Managing the Services Supply Chain', *Journal of Supply Chain Management*, November 2004
- Ellram, L.M., Siferd, S. (1998), 'Total Cost of Ownership: A key concept in Strategic Cost Management Decisions', *Journal of Business Logistics*, Vol. 19, No. 1 (1998)
- Emmett, S, Crocker B (2008), 'Excellence in Procurement: How to optimise costs and add value', *Cambridge Academic*

References

- Farris, M. T., Hutchison, P. D. (2002), 'Cash-to-Cash: the new supply chain management metric', *International Journal of Physical Distribution & Logistics*, Vol. 32, No. 4 (2002)
- Gelderman, C.J., van Weele, A.J. (2005), 'Purchasing Portfolio Models: A Critique and Update', *Journal of Supply Chain Management*; Summer 2005; 41,3
- Gibson, B.J., Mentzer, J.T., Cook R.L. (2005), "Supply Chain Management: The pursuit of a consensus definition", *Journal of Business Logistics*, Vol. 26, No. 2, 2005
- Giunipero, L. Handfield, R.B., Eltantawy R. (2006), 'Supply Management's evolution: Key skill sets for the supply manager of the future', *International Journal of Operations & Production Management*, Vol. 26 No. 7
- Goldratt, E M, Cox, J (1992) 'The Goal - A Process of Ongoing Improvement', *North River Press Publishing Corporation*, 2nd edition
- Gordon, S. (2008), 'Supplier Evaluation and Performance Excellence', *J. Ross Publishing*
- Gulledge, T., Chavusholu, T. (2007), 'Automating the construction of supply chain key performance indicators', *Industrial Management and Data Systems*; Vol. 108, No. 6, 2008
- Gunasekaran, A., Patel, C. and McGaughey, R.E. (2004), 'A framework for supply chain performance measurement' *International Journal of Production Economics*, Volume 87, 2004
- Gunasekaran, A., Patel, C. and Tirtiroglu, E. (2001), 'Performance measures and metrics in a supply chain environment', *International Journal of Operations and Production Management*, Vol. 21 Nos 1/2, pp. 71-87.
- Hancock, D.R., Algozzine, B. (2006), 'Doing Case Study Research' *Teachers College Press*, 12/1, 2007 52-59

References

- Handfield, R.B., Nichols, E.L.(2002) 'Supply Chain Redesign: Transforming Supply Chains into Integrated Value Systems'. *FT Press, Prentice Hall*
- Heinrich, C., Simchi-Levi, D. (2005), 'Do IT Investments really pay-off?', *Supply Chain Management Review, May/June2005*
- Holmberg, S. (2000), 'A systems perspective on supply chain measurements', *International Journal of Physical Distribution & Logistics*, Vol. 30, No. 10 (2000)
- Huan, S.H., Sheoran, S.K. Wang, G. (2004), 'A review and analysis of supply chain operations (SCOR) model', *Supply Chain Management: An International*, Vol. 9, No. 1
- IDC (2010), 'Top 10 Predictions for the Telecommunications Industry', *Downloaded from the Telecom NZ Intranet*
- Insight (2008), 'The Future for Telecom Suppliers', *Telecom and Media Insight, November 2008*
- ISM (2006). 'What's in a Name?' *Corporate Meetings & Incentives*, 25(6), 25. Retrieved from Business Source Complete database 02.11.2010
- ISM (2010). 'Institute for Supply Management: Official position statement' Accessed 02.11.2010, from <http://www.ism.ws/files/about/PSSMInput.pdf>
- ISM (2010a). 'Supply Management defined' Accessed 02.11.2010, from <http://www.ism.ws/tools/content.cfm?ItemNumber=5558&navItemNumber=20096>
- Kaipia, R., Tanskanen K. (2003), 'Vendor managed category management – an outsourcing solution in retailing', *Journal of Purchasing & Supply Management*; 9 2003; 165-175
- Kalakota, R. and Robinson, M. (2001), 'e-Business 2.0: Roadmap for Success', *Addison Wesley Longman, Boston (MA)*

References

- Koh, L., Saad, S., Arunachalam, S (2006), 'Competing in the 21st century supply chain through supply chain management and enterprise resource planning integration', *International Journal of Physical Distribution & Logistics*, Vol. 36, No. 6 (2006)
- Koulikoff-Souviron, M., Harrison A. (2005), A. 'Using Case Study Methods in Researching Supply Chains' Article in book 'Research Methodologies in Supply Chain Management – edited by Kotzab, Seuring, Muller and Reiner', *Physica-Verlag, Springer*
- Krajewski, L J, Ritzman, L P, & Malhotra, M K (2007) 'Operations Management, Processes and Value Chains' (8th ed.). Upper Saddle River, NJ: *Prentice Hall*.
- Kraljic, P (1983), 'Purchasing must become Supply Management', *Harvard Business Review*, September-October 1983
- Lambert (2010), 'The Supply Chain Management Processes', Available from Supply Chain Management Institute, <http://scm-institute.org/Our-Relationship-Based-Business-Model.htm> downloaded 7/4/2010
- Lambert, D. M., Cooper, M.C. (2000), 'Issues in Supply Chain Management', *Industrial Marketing Management*, Vol. 29, No. 1 (January 2000)
- Lambert, D. M., Pohlen, T.L. (2001), 'Supply Chain Metrics', *The International Journal of Logistics Management*, Vol. 12, No. 1 (2001)
- Leenders, M. R., Fearon, H. E., Flynn, A. E., & Johnson, P. F. (2002). 'Purchasing and supply management (12 ed.)'. *New York: McGraw-Hill*.
- Lockamy, A. McCormack, K. (2004a), 'The development of a supply chain management process maturity model using the concepts of business process orientation', *Supply Chain Management: An International Journal*, Vol. 9 No. 4

References

- Lockamy, A. McCormack, K. (2004b), 'Linking SCOR planning practices to supply chain performance', *International Journal of Operations & Production Management*, Vol. 24 No. 12
- Market New Zealand (2008) 'Telecommunications and wireless industry in New Zealand', <http://www.marketnewzealand.com/common/files/Telecommunications-and-wireless-industry-in-New-Zealand.pdf>, downloaded 12/10/2009
- McCormack, K., Ladeira, B.M. de Oliveria M.P.V. (2008), 'Supply chain maturity and performance in Brazil', *Supply Chain Management: An International Journal*, Vol. 13 No. 4
- Melnyk, S.A., Lummus, R.R., Vokurka, R.J., Burns, L.J and Sandor, J. (2009), 'Mapping the future of Supply Chain Management: a Delphi study', *International Journal of Production Research*, Vol. 47 Nos 16, 15, August 2009.
- Mentzer, J.T., Dewitt, W., Keebler, J.S., Min, S., Nix, N., Smith, C.D. and Zach, Z.G. (2001), "Defining supply chain management", *Journal of Business Logistics*, Vol. 22, No. 2
- Mollenkopf, D. and Dapiran, G.P. (2005) 'World-class logistics: Australia and New Zealand', *International Journal of Physical Distribution & Logistics*, Vol. 35, No. 1 (2005)
- Monczka, R M, Trent, R J, Handfield, R, (2005) 'Purchasing and Supply Chain Management' (3rd ed), *Thomson South-Western*
- Nagle, T., Finnegan, P. and Hayes, J. (2006), 'The effects of business-to-business relationships on electronic procurement systems: an exploratory study', *Proceedings of the European Conference on Information System (ECIS 2007)*, 7-9 June, St. Gallen
- Nicholas, J.M (1998) 'Competitive Manufacturing Management: Continuous Improvement, lean production and customer-focused quality', *McGraw-Hill* Boston

References

- O'Brien, J. (2009), 'Category Management in Purchasing', *Kogan Page Limited*
- Ogden J.A., Petersen K.J., Carter J.R. Monczka R.M. (2005), 'Supply Management Strategies for the future: A Delphi Study', *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, Copyright by the Institute for Supply Management, Inc., August 2005
- Oliver, P. (2004) 'Writing your thesis', *Sage Publications*
- Pandit, K., Marmanis, H. (2008) 'Spend Analysis – The Window into Strategic Sourcing', *J. Ross Publishing, USA*
- Reck, R., & Long, B. (1988) 'Purchasing: A Competitive Weapon', *Journal of Purchasing & Materials Management*, 24(3), 2-8.
- Rother, M, Shook J (1999), 'Learning to See', *The Lean Enterprise Institute, USA*
- Sammon D & Hanley P (2007) 'Communication Methods, information sharing, supplier development and performance', *Supply Chain Management An International Journal of Operations*, Vol 12, No. 4, 2007
- Santema, S.C., Kopecka, J.A. (2005) 'E-Procurement: In search of the value of tools' *IMP Conference, Rotterdam*, 1-3 September, available from www.impgroup.org.
- Santema, S.C., Reunis, M.R.B. (2003) 'eTransformation in Supply Chain Perspective', *Proceedings of the 16th Bled eCommerce Conference*, Bled, Slovenia.
- SAP (2010) 'The SCOR Model', SAP SCM Help website, Available 'http://help.sap.com/saphelp_scm50/helpdata/EN/f9/bc7c37c3b97f45e10000009b38f8cf/content.htm', accessed on 24/05/2010
- Saunders M, Lewis P, Thornhill A (2009), 'Research methods for business students', 5th edition; *Pearson Education England*, Prentice Hall

References

- SCC (2010a), 'Supply Chain Operations Reference Model', Supply Chain Council, http://supply-chain.org/f/SCOR%2090%20Overview%20Booklet_0.pdf, accessed 24/05/2010
- SCC (2010b), 'SCOR Quick Reference', Supply Chain Council, <http://supply-chain.org/f/SCOR%2090%20Quick%20Reference.pdf>, accessed 24/05/2010
- Schuh, C., Kromoser, R., Strohmer, M., Perez, R. and Triplat A. (2009), 'The Purchasing Chessboard', *Springer-Verlag*
- Seuring, S. (2005), A. 'Case Study Research in Supply Chains – An Outline and Three Examples' Article in book 'Research Methodologies in Supply Chain Management – edited by Kotzab, Seuring, Muller and Reiner', *Physica-Verlag, Springer*
- Shapiro J. F. (2001), 'Modeling the supply chain', Pacific Grove, CA: *Duxbury Press*
- Simchi-Levi D, Kaminsky P, Simchi-Levi E and Shankar R (2008) 'Designing and Managing the Supply Chain', 3rd edition, *Tata McGraw-Hill*
- Stock, J.R., Boyer, S.L., (2009), 'Developing a consensus definition of supply chain management: a qualitative study', *International Journal of Physical Distribution & Logistics*, Vol. 39, No. 8 (2009)
- Tai, Y., Ho, Chin-Fu and Wu, W. (2010) 'The performance impact of implementing Web-based e-procurement systems', *International Journal of Production Research*, 48: 18
- Telecom (2009), 'About Telecom NZ', *Adapted from* <http://www.telecom.co.nz>
- Telecom (2010), 'Telecom Organisation Structure' Available <http://www.telecom.co.nz>

References

- Telecom ALM (2007), 'Work done by the author and others on the 'Telecom Asset Lifecycle Management Project', *Telecom New Zealand*
- Tellis, W. (1997). 'Introduction to case study', *The Qualitative Report*, July 1997
Available: <http://www.nova.edu/ssss/QR/QR3-2/tellis1.html>
- Tellis, W. (1997, September). 'Application of a case study methodology [81 paragraphs]. *The Qualitative Report*. Available:<http://www.nova.edu/ssss/QR/QR3-3/tellis2.html>
- Trent, R (2007) 'Strategic Supply Management: Creating the Next Source of Competitive Advantage', *J. Ross Publishing*, USA
- Trent, R J and Monczka, R M (1999) 'Achieving world-class supplier quality', *Total Quality Management*, Vol 10, No 6
- Van Weele, A.J (2005), 'Purchasing and supply chain management: Analysis, strategy, planning and practice', 4th edition; *Thomson Press*
- Voudoris, C., Owusu, G., Dorne, R. and Lesaint, D. (2008), 'Service Chain Management – Technology Innovation for the Service Business', *Springer-Verlag*
- Wickramatillake, C.D., Koh Lenny, S.C., Gunasekaran, A. and Arunachalam, C (2007), 'Measuring performance within the supply chain of a large scale project' *Supply Chain Management: An International Journal*, 12/1, 2007 52-59
- Xia, X.X.L (2006), 'Supply Chain Modelling and Improvement in Telecom Industry: A Case Study' *2006 IEEE International Conference on Industrial Informatics*
- Yin, R. (1993), 'Applications of case study research'. *Beverly Hills, CA: Sage Publishing*.
- Yin, R. (2003), 'Case study research: Design and methods' (3rd ed.). *Sage Publishing*.

References

Zsidisin, G.A, Ellram, L.M. (2003), 'The relationship between purchasing and supply management's perceived value and participation in strategic supplier cost management activities', *Journal of Business Logistics*, Vol. 24, No. 2 (2003)

Zycus (2008) 'The Path to Procurement Excellence' *Zycus Inc*, Available: <http://www.zycus.com>

APPENDICES

Appendix A – Category Architecture

Category	Description
Field Services	
FS Maintenance & Support	Field Maintenance e.g. fault fixing
Build & Deployment	Building and Deploying the physical network
Provisioning	Field provisioning e.g. plugging in cards etc.
Engineering & Building Services	Facilities management, Engineering / building services, Associated professional engineering advisory for network sites.
Facilities	
Furniture & Fittings	Corporate furniture and fittings
Facilities Management	Corporate facilities management of people sites including security and safety
Car Parking	Corporate car parking
Cleaning	Cleaning & associated soft services inc. Pest Control, Fem. Hygiene, Laundry etc.
Energy & Power	Purchase of electricity supply and associated billing services for all sites.
Hospitality & Catering	Catering, Hospitality & Front of House services
Property	Corporate Property leases and property insurance costs
Office Supplies & Stationery	Liquor, flowers etc
HR	
Permanent Recruitment	Permanent Telecom recruitment outsourced service and associated agency costs

Category	Description
Contract Labour	Usage of temporary staff to supplement our permanent workforce where the payment for services could be made on a time based rate
Training	Staff Training and education, further education
Employee Welfare Health & Safety	Staff incentives, BYB, employee health and safety
Travel	
Air Travel	Corporate Air Travel
Accommodation	Corporate accommodation
Transport	Taxis, rental vehicles, event transport
Fleet	Company fleet and fuel
Travel & Event Management	Corporate Events and TMC's
Logistics	
Freight	Freight and Customs Clearance
Post & Couriers	NZ postal services, couriers
Warehousing & Distribution	Inventory and spares storage and distribution
Professional Services	
Business Consulting	Management, Technical, legal, Accounting and HR Consultancy Services.
Financial Services	Banking services & non property related insurance
Outsourced Contact Centres	Outsourced call centres and back office functions both onshore and offshore
IS Consulting & Build	Consulting and systems integration, broadly including project mgmt, design, testing & deployment of information systems solutions (both internal & managed services).
IS Operations	Cost of operating the systems

Appendices

Category	Description
Network Consulting & Build	Consulting and systems integration, broadly including project management, design, testing and deployment of mobile and fixed line network solutions.
Network Operations	Network optimisation, planning, dimensioning and resolution of integration issues once in a BAU state.
Network Hardware & Software	
Cables	Copper and Fibre optic cables
Cabinets & Frames	Roadside/access cabinets and main distribution frames etc
Batteries & UPS	Batteries & Uninterruptable power supplies serving people, buildings & network sites
NW Maintenance & Support	Network Return & repair, support & maintenance, break/fix & software support & upgrade rights.
Fixed Network	Fixed Network electronic hardware including CLNE.
Mobile Network	Mobile Network electronic hardware
Software	
Purchased Software	Purchase of a software package
Licenses	Payment of license costs
Software Support & Maintenance	Maintenance charges
IS Hardware	
Consumables & Peripherals	Print and Desktop/Laptop consumables and peripherals including audio visual equipment
Desktop & Laptop	Purchase of equipment for Desktop & Laptop physical environment but not support
Servers	Generic Servers
Printers	Print hardware and corporate office print services
Storage	Electronic data storage
Hardware Maintenance	Hardware maintain and fix

Category	Description
Marketing	
Media	Media Agency spend, media placement and advertising
Agency	Above and below the line Creative agency design
Print	Marketing print, operational print, base stationery, customer correspondence, paper and print fulfilment
PR & Sponsorship	Corporate and business unit sponsorship, charitable donations and public relations agency spend.
Promotional	Telecom branded or non-branded Products for staff/customers used for promotional purposes only.
Market Research	Market Data, business information and subscriptions
Customer	
Mobile Hardware	Procurement mobile hardware and accessories
Customer Content	e.g. Broadband, Mobile
CPE	Consumer Premise Equipment e.g. modems, land line handsets, PABX
Unimpactable	
Interconnect & Roaming	For all Interconnect & Roaming charges
Gen-i Use only	Temporary category until Gen-i amend all the material data
Dealer Payments	For dealer payments only
Data Revenue, Commission & Profit Share	Data Revenue, Commission and Profit share
Government	Use for Council Fees, Payroll etc.
To be assigned	A temporary category to be used for vendors not yet reviewed and yet to be assigned
Unassigned	Other Unassigned

Appendix B – Non-Disclosure Agreement