THE IDENTIFICATION OF THE MOST APPROPRIATE KEY PERFORMANCE INDICATORS FOR USE IN NEW VENDOR SELECTION.

By

Michael Costello

A Research Dissertation submitted in partial fulfilment for the Degree of Masters of Science in Technology Management.

National University of Ireland
Galway

Research registered in the Faculty of Science and Engineering
Department of Mathematics and Statistics

University of Limerick

Research Supervisor: Dr Con Sheahan B. Eng., MIEI, MBA, PhD

Submission: September 2009

Final Project/Thesis Submission

MSc Technology Management

University of Limerick

Student Name: Michael Costello

Telephone: 086-8301526

E-mail: mickcostello@hotmail.com

Date of Submission: September 1st 2009

Title of Submission: The identification of the most appropriate key performance indicators for use in new vendor selection.

Supervisor Name: Dr Con Sheahan B. Eng., MIEI, MBA, PhD

Certification of Authorship:

I hereby certify that I am the author of this document and that any assistance I received in its preparation is fully acknowledged and disclosed in the document. I have also cited all sources from which I obtained data, ideas or words that are copied directly or paraphrased in the document. Sources are properly credited according to accepted standards for professional publications. I also certify that this paper was prepared by me for the purpose of partial fulfillment of requirements for the Degree Program.

Signed: _____ Date: _____

Acknowledgements

I would like to thank my research supervisor Dr Con Sheahan for his guidance, expertise and remarkable patience while directing me through this Thesis. In addition to giving direct guidance Con has included me in other UL research groups which became a great source of direction and motivation, for this I am very grateful.

I express my gratitude to the Atlantic University Alliance personnel who have facilitated me in every way possible throughout this 2 year MSc. programme.

I would like to thank all those that contributed data to this thesis, those that shared their company processes, gave time to participate in interviews and the 60 person panel that completed the survey questionnaire. Without such input this thesis would not be possible.

I would like to thank my classmates, particularly the Galway group. The regular Saturday morning exam revision, thesis review and general group therapy sessions made this course an entirely more enjoyable experience.

Thank you to friends, family and my parents for the space and unrelenting support to allow me to see this ambition through.

Table of Contents

Chapter 5 Research Methodology

Chapter 6 Results Review and Analysis

Chapter 7 Discussion, Conclusions and Recommendations

Bibliography

Appendices

List of Tables

List of Figures

Abstract

Material suppliers can play a very large role in the success of manufacturing firms. While Porter (1979) described suppliers as a competitive force, Childe (1998) recognised them as business partners in the extended enterprise. Given their importance it is reasonable to expect the appropriate resources and methodologies are employed in selecting the best suppliers. In addition to purchasing professionals, vendor selection processes should involve multifunctional teams to identify the most appropriate selection criteria or key performance criteria that proposed new suppliers may be measured against.

This thesis contends that for many firms the "reality does not match the rhetoric". While firms may have vendor selection procedures in place they are often generic and ineffective. The procedures do not offer metrics important to the firm, does not engage stakeholders within the firm such as quality, logistics and engineering and are not value adding. An analysis of the procedures used by 7 manufacturing firms supports this.

Through an empirical cross-sectional survey of 78 professionals working in various functional groups in manufacturing industries this research has determined the attitude and degree of involvement of these individuals in new vendor selection.

In 1966 Gary Dickson proposed 23 vendor selection criteria surveying 273 purchasing managers and agents to rank them in order of importance. This thesis has proposed 12 new Key Performance Indicators for use in vendor selection. These have been evaluated and ranked by the survey group described above indicating that cost, quality and delivery remain of the greatest concern when selecting new suppliers.

Chapter 1: Introduction

1.1 Motivation and Research Objective

The ever expanding role of material suppliers cannot be understated. Material suppliers can play a very important part in the success of manufacturing firms. While Porter (1979) described suppliers as a competitive force, Childe (1998) recognised them as business partners in the extended enterprise. Over the past few decades new manufacturing concepts and methodologies such as TQM, JIT and ERP have irreversibly changed the role of the supplier.

The strategy of many organisations has become that of "do what you do best" focussing on the organisations core competencies and outsourcing operations that are not within their core competencies to suppliers. As a result of this trend manufacturers have come to look to their suppliers increasingly to take on non-core manufacturing activities. The supplier has become mare responsible for the total value of the finished product. Childe (1998) described this concept as co-making. This co-makership has extended the role of the supplier to include greater involvement in product design and development. Rapid advances in communication technologies have resulted in streamlining of the supply chain, simplifying the ordering and invoice and invoicing processes. These advances have changed the relationship with the supplier from that of adversarial short term contracts with threats of de-listing to one of long term strategic alliances.

Stalk et al. (1992) contend that the meteoric rise of US retail giant Wal-Mart can in no small part be attributed to their relationships with their suppliers and state of the art supply chain management. MacDuffie and Helper (1997) have researched the success of Honda when establishing manufacturing sites in the US in the late 1970's. Much of their success has been attributed to efficiencies gained through their addition of value through the supply chain. This was achieved through forging strong strategic relationships with their suppliers, a novel concept in the US at the time.

Given the importance of the supplier it would be reasonable to expect the appropriate resources and methodologies are employed in selecting the best suppliers. It is the experience of the author that this is not the case.

Much of the published literature on supplier selection has focussed on mathematical models that may be used for decision making rather than identifying the best criteria for supplier selection. These models (DEA, AHP, GRA etc.) provide mathematical solutions to analysing multiple and sometimes conflicting variables but fail to propose real metrics to support these empirical studies.

In 1966 Gary Dickson published an article in which he proposed 23 different criteria that may be used in new vendor selection. He then circulated a survey to purchasing professionals inviting them to evaluate and rank the criteria in order of importance. In 1991 Weber et al. re-evaluated relevance of the 23 criteria 25 years after the original publication. They did this through a literature review of all articles published on vendor selection to that date and determined how frequently the Dickson 23 criteria were discussed.

Similar to the work of Dickson this thesis will propose a series of vendor selection criteria. These criteria or Key Performance Indicators will offer real metrics rather than the subjective opinion scores offered by other authors. The proposed Key Performance Indicators will be evaluated for usefulness by a group of peers in industry. This will be achieved through an empirical cross-sectional survey of 78 professionals working in various functional groups in manufacturing industries

The objective of this research is to answer 2 principle questions

1. *What is the attitude and degree of involvement of individuals within manufacturing companies in new vendor selection?*
2. *Which of the proposed metrics are regarded as most important by individuals within manufacturing companies and how useful are these metrics?*

1.2 Structure of thesis

Including this chapter this thesis is comprised of 7 chapters and appendices.

Chapter 2, the literature review will search the body of published knowledge available to gain a better understanding of the role of the supplier and the various approaches to selecting them. The literature review will define the role of the supplier and establish how this role has changed since the advent of the Extended Enterprise paradigm. The chapter will then review the literature published on the selection of new suppliers. In addition to identifying those criteria considered most important by these authors the section will review some of the proposed methodology used to apply these in a vendor selection process.
Following what various authors have published on this subject, the literature review will determine the regulatory perspective, through a review of guidelines published by various regulatory organisations. This review will centre on ISO: 9001 and guidelines used in the pharmaceutical industry.
In order to establish context, in **Chapter 3** a study of the vendor selection procedures employed by 7 different manufacturing firms will be carried out. Each company's procedure will be summarised and an attempt will be made to identify the rationale driving the selection of each set of criteria.
Having examined the approach of regulatory bodies, those in published articles and the current approach to new vendor selection adopted by a sample of real manufacturing companies, **Chapter 4** will proceed to propose a set of Key Performance Indicators to be considered when selecting new vendors. These metrics will fall in to 4 main categories, Financial, Quality, Logistic and Innovation. A rationale will be given in support of each metric.
Chapter 5 will define the research methodologies used in the study, explaining the two primary research questions the rationale behind the survey group selection and survey method. The methodology used in this thesis has been sourced primarily from the book "Research Methods for Business Students" by Saunders et al. (2007).

This research will attempt to answer 2 Primary questions.

1. What is the attitude and degree of involvement of individuals within manufacturing companies in new vendor selection?
2. Which of the proposed metrics are regarded as most important by individuals within manufacturing companies and how useful are these metrics?

Copies of the survey may be found in appendix A.

Chapter 6 will review and analyse the results of the surveys. The survey group will be broken down and graphed in respect to functional group and the business they operate in. The chapter will then tabulate and graph the response to each of the questions. In survey 1, the response to each question will be reviewed and examined in the context of some of the comments supplied. The results survey 2 will then be tabulated and graphed in order to determine the most preferred key performance indicators according to the survey group. A summary of the survey group and response data may be found in appendices B, C and D.

Chapter 7 will discuss the research results in the context of the literature review and the study carried out on other firms. The results of survey 2 will be compared to similar work carried out by Dickson (1966) and Weber et al. (1991). The chapter will then attempt to draw some conclusions from this work. The chapter will also identify the limitations of the research and recommend some opportunities for further research.

Chapter 2: Literature Review

2.1 Introduction

The literature review will search the body of published knowledge available, to gain a better understanding of the role of the supplier and the various approaches to selecting them. This review will be carried out in following 3 general headings.

A. The Role of the supplier and the Extended Enterprise.
B. Vendor Selection.
C. A Regulatory Perspective.

Through a review of published articles on competitive strategy section 2.2 will determine the role of the supplier in an organisations strategy. By recognising how a suppliers core competencies can compliment those already existing in a firm it will become more clear the advantages to be gained through sourcing from the right suppliers. Through gaining an understanding of the concept of the Extended Enterprise it will become clear the how the suppliers role has become more an intrinsic part of an organisations success.

Having recognised the growing importance of selecting the right supplier section 2.3 will review the published material available on vendor selection. In addition to identifying those criteria considered most important by these authors the section will review some of the proposed methodology used to apply these in a vendor selection process.

Following what various authors have published on this subject, section 2.4 will determine the regulatory perspective, through a review of guidelines published by various regulatory organisations. This review will centre on ISO: 9001 and guidelines used in the pharmaceutical industry.

Section 2.4 will contain a brief summary of the chapter.

2.2 The Role of the Supplier and the Extended Enterprise

Porter (1979) in his seminal article "How competitive forces Shape Strategy" has identified the supplier as one of the five principle forces that must be considered when formulating a competitive strategy. See fig. 2.2.1 below. He contends that the bargaining power of the supplier must not be underestimated particularly where the goods or service they supply is unique or sufficiently differentiated to make switching supplier result in an inferior product, long delays or higher costs. This is not unusual where the goods supplied form an integral part of the final product or where in highly automated industries a considerable degree of capital investment is required to run these goods.

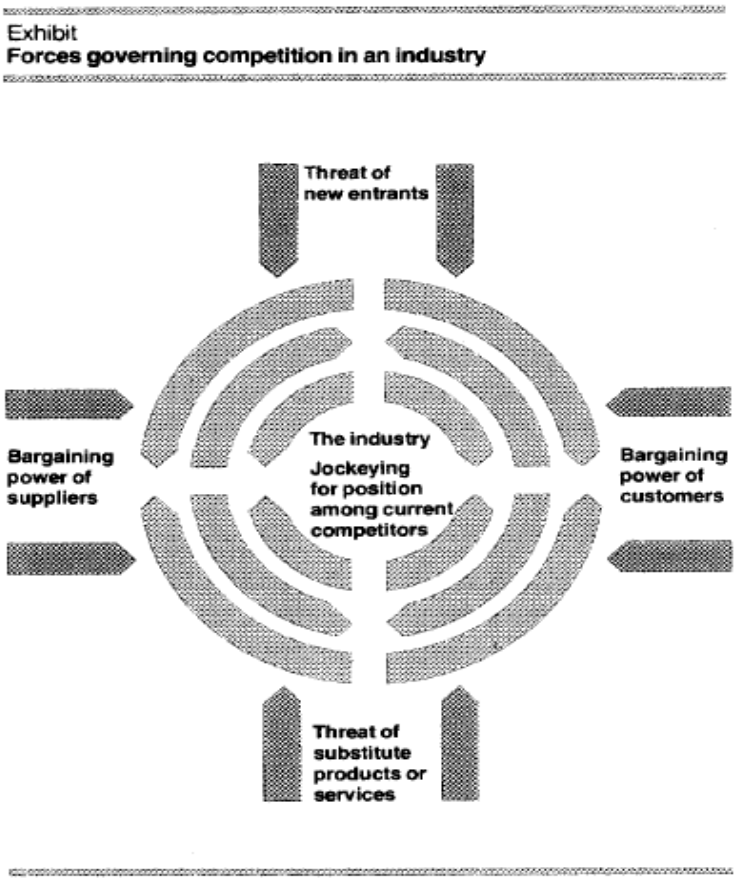


Fig 2.2.1 Five Forces Governing Competition in Industry. Porter (1979)

Barney (1991) suggests that an organisation must identify and focus on core competencies. Prahalad and Hamel (1990) in their article "The Core Competence of the Organisation" advocate the investment in as many core technologies as possible. They highlight how Cannon through developing core technologies went on to dominate the photocopy industry. Though this is the case it may also be seen that the major computer manufacturers source chips and software through strategic suppliers rather than develop and manufacture them selves.

Stalk et al. (1992) in their article "Competing on Capabilities" describe the meteoric rise of retail giant Wal-Mart in the USA. A key element in their success has been a fast, accurate and efficient inventory replenishment system operating from point of sale data sources. Wal-Mart has recognised that this strategy was only possible through the willingness and flexibility of their suppliers. They reward this through offering better payment terms of an average 29 days from receipt of invoice compared to an industry standard of 45 days.

Womack and Jones (1994) in their article "From Lean Production to Lean Enterprise" have recognised the efficiencies gained by the Japanese motor industry through working with their suppliers to add value through the entire value chain. MacDuffie and Helper (1997) have looked at the arrival of Honda to the USA. In 1978 when Honda began manufacturing it needed to develop a local (American) network of suppliers. For Honda managerial attitudes such as willingness and responsiveness were much more important than technical expertise. Honda wanted suppliers that were willing to take risks, to invest in organisational and HR capabilities and embrace the Honda lean philosophy. In return Honda could offer a life time relationship. At the time Honda had experienced year on year sustained growth and could offer to their suppliers a similar consistent annual growth. In addition to sustained growth a supplier that was prepared to link closely to the Hondas strategic direction may be offered the opportunity to supply new goods or services that they may not have been within their capabilities in the past. Honda recognised the value of training and developing the capability of strategic suppliers rather than selecting new ones. The supplier had truly become a part of Hondas business.

The advent of the Extended Enterprise is probably best defined by Jagdev and Browne as follows ..

> *"The formation of closer co-ordination in the design, development, costing and the co-ordination of the respective manufacturing schedules of co-operating independent manufacturing enterprises and related suppliers"* (Jagdev & Browne, 1998, p217)

Childe (1998) in his article "The extended enterprise-a concept of co-operation" demonstrates very well the role of the supplier and the evolution of the extended enterprise. Childe describes how focus on related concepts such as supply chain management, value chain, supplier development and supplier networks have done much to forge closer relationships with the supplier, but proposing that the concept of the Extended Enterprise goes far beyond this. Childe describes this new closer supplier relationship as "*being asked to see the suppliers as part of the principle company*" (p.321). As the level of co-operation grows over time and with through decreasing profit margins a greater inter-dependence has evolved between companies and their suppliers.

Childe has identified the following trends in the supplier relationship;

- An increasing focus on Core Competences has encouraged companies to look to their suppliers increasingly to take on non-core manufacturing activities that they would have carried out in-house in the past.
- As suppliers take on more of the manufacturing activities for example providing sub-assemblies rather than loose components they become more responsible for the total value of the finished product.
- The concept of co-making the product with the supplier allows the opportunity for each organisation to focus on their core competence. By doing what they do best, greater value can be added to the product. This would be achieved through improved design and continuous improvement programmes.

- This Co-makership of the product generates new opportunities in streamlining the supply chain through simpler ordering and invoicing processed. This in turn will drive down costs.
- This new paradigm has fundamentally changed the relationship with the supplier. Adversarial management encompassing short-term contracts, spot-orders and threats of de-listing have given way to long-term strategic alliances.
- With this trend to outsource so many manufacturing activities greater emphasis has been placed on selecting and managing the right vendors.

Jagdev and Browne (1998) in their article "The extended enterprise – a context for manufacturing" have highlighted the following characteristics of the extended enterprise each of which is directly related to the input of the supplier.

- Outsourcing non-core activities to suppliers, encouraging both the manufacturers and suppliers competitive ability and enhancing mutual dependency to achieve mutual success.
- Long term relationships with key customers and suppliers treating them as important business partners.
- Development of new processes and technologies to enhance integration through the exchange of commercial and technical information.

The extended enterprise has brought fundamental changes to the function of purchasing and how suppliers are managed. The traditional role of purchasing had focussed on defining alternative suppliers, negotiating better prices and expediting deliveries. This role has now expanded to focus development of long-term relationships focussed on close collaboration for mutual success.
Jagdev and Browne (1998) have described the trend towards having a smaller number of key suppliers who in turn would have tier of their own key suppliers forming a pyramid type effect. These key suppliers will have early involvement in new product development and design, sharing costs and technical information

that would previously have been considered proprietary. They have listed the following characteristics of the supplier relationship within the extended enterprise.

1. A shared specific focus on satisfying their shared end customer.
2. An alignment of vision.
3. A fundamental level of co-operation and trust.
4. Effective and open communication.
5. Decisions are made by maximising the use of their individual knowledge and competencies.
6. A commitment of generate long term mutual benefits.
7. A common view on how success is measured.
8. A commitment to continuous improvement and break through advances.
9. Competitive barriers that exist in the environment are allowed to exist within the extended enterprise.

Jagdev and Browne (1998) go further to reference Boykin's (1997) attributes of a world class supplier.

- A world class Supplier assists in product development.
- A world class Supplier delivers error free products.
- A world class Supplier has a production system which delivers products on time, and a knowledge which assists customers in reducing time to Market.
- A world class Supplier creates and sustains relationships with all members of the supply chain that achieve superior results.
- A world class Supplier is an organisation that learns and adapts rapidly to respond to a world of rapid change.
- A world class Supplier attains a return on investment which contributes to the success of all members of the supply chain.

This section has reviewed the role of the supplier and the increasing influence it has on the strategy and value chain of an organisation. The extended enterprise has been defined and the new role played by the supplier in this. From the above it is clear that the selection of the right supplier can have considerable positive cost and value adding effects on an organisation and hence the success of the company. Selection of the wrong supplier can of course have a similar negative effect. Having established the criticality of having the right supplier section 2.3 will review methodologies published on selection of the right supplier.

2.3 Vendor Selection

Goffin et al. (1997) have highlighted how the in procurement strategy has changed with the evolution of supply chain management. Close long-term relationships have replaced the old traditional adversarial style of placing spot orders with the supplier that offered the lowest price. The trend has been to invest more business with fewer suppliers. This was demonstrated using a UK survey across 4 different business sectors from 1991 to 1995. See *table 2.3.1 below.*

Industrial sector	Sample (*n*)	1991	1993	1995	Percentage reduction 1991-95
Process	30	221	199	142	36
Engineering	63	496	400	316	36
Electronics	34	382	304	250	35
Household	74	107	99	97	9
Total	*N* = 201				

Table 2.3.1 Supplier Reduction across various businesses in UK 1991 – 1995 Goffin et al. (1997)

This trend has created a greater focus on selecting the right supplier. The traditional unit cost, lead time, and quality have been replaced with total cost, JIT delivery capability and use of TQM. Longer term relationships have driven new criteria such as financial stability, technical capabilities and organisational culture aspects. Trends in corporate relations have driven a new focus on suppliers' environmental standards and employee relations.

In a similar manner when the Delphi corporation went "Lean" they reduced their supply base from 7000 suppliers in 2002 to 4000 suppliers in 2004 also discovering that less resources were needed to maintain supplier relationships. (Nelson, 2004).

Goffin et al. (1997) have highlighted that relatively little has been published on the best method to be used in supplier selection. This section will review the published literature available on new supplier selection focussing on the criteria to be used and identifying some of the recommended methodology.

Vonderembse and Tracey (1999) argue that selection of the right vendor and involvement of the supplier in product development and manufacturing has a direct impact on a firm's manufacturing performance. See *fig 2.3.1* below.

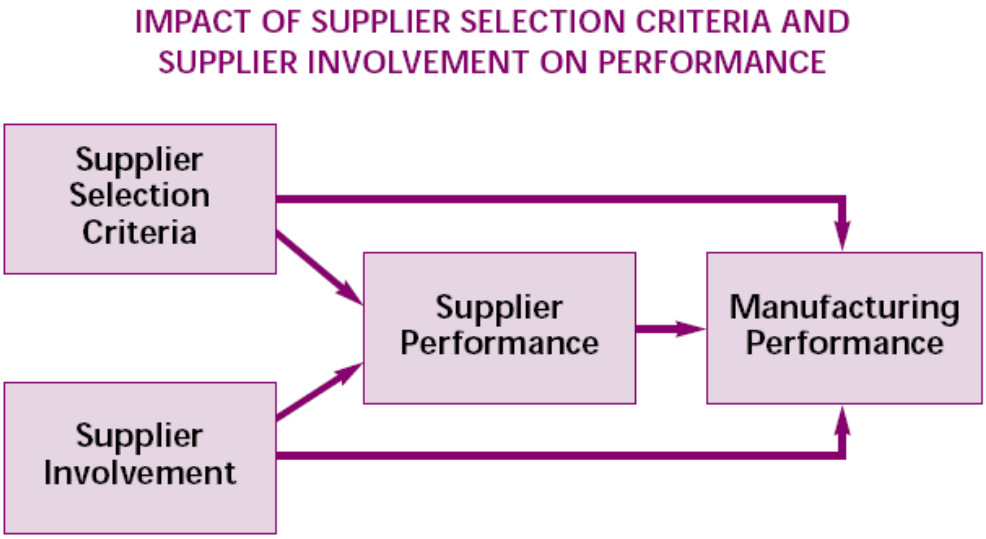


Fig 2.3.1 Vonderembse and Tracey (1999)

As part of their 1999 study they surveyed 2000 firms with a questionnaire regarding supplier selection criteria, supplier involvement and supplier performance. This thesis will focus on supplier selection. The questionnaire required the participant to rate the importance of product quality, product availability, delivery reliability and product performance as supplier selection criteria. They used the likert scale (a score of 5 for very important to a score of 1 for very un-important) to assess these. 268 participants replied. In addition to the questionnaire Vonderembse and Tracey used a series of 5 measures to rate these firms in terms of manufacturing performance. These measures included

1. Production rework costs have declined
2. Production costs per unit finished product have decreased
3. Outgoing product quality has increased
4. Work-in-progress inventories have decreased
5. Outgoing products are delivered on time.

The firms were evaluated and divided into 2 groups those that scored above average, with high manufacturing performance and those below average with low manufacturing performance. 160 firms were found to have a high manufacturing performance, 102 a low manufacturing performance while 6 were eliminated due to incomplete surveys. The results were as follows:

	High Manufacturing Performers (n=160)		Low Manufacturing Performers (n=102)	
Supplier Selection Criteria: Importance of	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
1. Product Quality	4.92	0.29	4.74	0.57
2. Product Availability	4.51	0.59	4.49	0.65
3. Delivery Reliability	4.62	0.57	4.48	0.65
4. Product Performance	4.82	0.4	4.55	0.65

Vonderembse and Tracey argue that the firms with the higher manufacturing performance consistently place a higher value on each of the supplier selection criteria. The more consistent agreement of the higher manufacturing performers can be seen in the lower standard deviations. It can also be determined that from this data that these firms value, Quality, Performance, Delivery Reliability and Product Availability in this that order.

Vonderembse and Tracey argue that the firms that put grater value and there-fore more effort into new supplier selection deliver a better manufacturing performance. They contend that management and purchasing professionals in manufacturing firms need to move away from “lowest bid wins” approach to purchasing and focus on real multi criteria assessments when sourcing new suppliers.

Weber (1991) in his article "Vendor Selection Criteria and Methods" has made a significant contribution to understanding the earlier history of vendor selection criteria. Beginning with a critique of Dickson's (1966) seminal article "An analysis of vendor selection systems and decisions" Weber has looked at how business needs have changed since 1966 followed by a review of the literature available on the subject in 1991.

In 1966 Dickson proposed a set of 23 potential vendor selection criteria. He circulated these criteria in the form a questionnaire to establish the relative importance of these criteria. Dickson sent the questionnaire to 273 purchasing agents and managers selected from the membership list of the National Association of Purchasing Managers (US). 170 of these based in the US and Canada completed the survey. The results may be seen in *table 2.3.2.*

Dickson's vendor selection criteria [a]

Rank	Factor	Mean rating	Evaluation
1	Quality	3.508	Extreme importance
2	Delivery	3.417	
3	Performance history	2.998	
4	Warranties and claim policies	2.849	
5	Production facilities and capacity	2.775	Considerable importance
6	Price	2.758	
7	Technical capability	2.545	
8	Financial position	2.514	
9	Procedural compliance	2.488	
10	Communication system	2.426	
11	Reputation and position in industry	2.412	
12	Desire for business	2.256	
13	Management and organization	2.216	
14	Operating controls	2.211	Average importance
15	Repair service	2.187	
16	Attitude	2.120	
17	Impression	2.054	
18	Packaging ability	2.009	
19	Labor relations record	2.003	
20	Geographical location	1.872	
21	Amount of past business	1.597	
22	Training aids	1.537	
23	Reciprocal arrangements	0.610	Slight importance

Table 2.3.2 Dickson's results from the vendor selection criteria survey 1966

Weber's principle critique of Dickson's work has been the lack of clarity defining the criteria. For example "Performance History" may refer to delivery or quality, attitude and impression can be very subjective. However Dickson's survey has provided an excellent snap-shot of what was considered the most important selection criteria in 1966.

Weber's work in 1991 has been based on the literature published on this subject up to 1991. Weber has taken Dickson's 23 criteria and determined their relative importance through counting the number of published articles referencing each of them. 74 articles were included in this review. Weber's results may be seen in *table 2.3.3.*

Criteria discussed in annotated bibliography

Dickson's study		Criteria	Number of articles	(%)
Rank	Rating [a]			
6	1	Net price	61	80
2	1	Delivery	44	58
1	1A	Quality	40	53
5	1	Production facilities and capacity	23	30
20	2	Geographic location	16	21
7	1	Technical capability	15	20
13	2	Management and organization	10	13
11	2	Reputation and position in industry	8	11
8	1	Financial position	7	9
3	1	Performance history	7	9
15	2	Repair service	7	9
16	2	Attitude	6	8
18	2	Packaging ability	3	4
14	2	Operational controls	3	4
22	2	Training aids	2	3
9	2	Bidding procedural compliance	2	3
19	2	Labor relations record	2	3
10	2	Communication system	2	3
23	3	Reciprocal arrangements	2	3
17	2	Impression	2	3
12	2	Desire for business	1	1
21	2	Amount of past business	1	1
4	1	Warranties and claims	0	0

[a] Ratings: 1A = Extreme importance. 2 = Average importance.
1 = Considerable importance. 3 = Slight importance.

Table 2.3.3 Weber's results from the vendor selection criteria survey 1991

It is worth noting that there have been many changes in manufacturing in the 25 years between these 2 pieces of research. The principle change has been in the introduction of Just In Time (JIT) manufacturing where large inventories are to be avoided and shorter lead times desired. This may be reflected in the move of "Global location" from a rank of 20 in 1966 to 4 in 1991. Having the supplier

near-by should help reduce lead time and thus large inventories. Costs have also become a major consideration moving to the primary concern from a rank of number 6 in 1966.

In his summary of the 74 articles reviewed, Weber (1991) has expressed surprise the lack of the application of quantitative methods to vendor selection. He states that given the "*complexity and economic importance of vendor selection*" and the "*multi-objective nature of this problem*" that multi-objective programming techniques have not been put in use. He suggests that such techniques would allow purchasers systemically examine the trade-offs among the criteria delivering the suppliers that best meet the companies needs.

Manzer et al. (1980) have highlighted the importance of vendor selection to smaller business claiming that 20 to 50 cent of each manufacturer sales dollar is spent on materials. They have recognised that there are many vendor selection methodologies using quantitative tools and decision making algorithms already in existence. They argue that these methodologies though structurally sound are of limited use to small business due to the "*enormous information demands and quantitative sophistication"* requiring specialist resources not available to small business. They have proposed a matrix approach to vendor selection optimising the methodologies available but without taxing the small business managers' information and processing capabilities. The process is relatively simple where they identify what they consider the most important evaluation factors for selecting new vendors, placing a weighting on these factors and developing a score card based on this data. The score card can then be used to allocate an empirical value on each potential supplier. They claim the following advantages to their matrix proposal.

1. Use of the matrix forces the organisation to identify the criteria/variables most valued by that particular company.
2. While subjective opinions will still have a role in the final decision their matrix proposal reduces subjectivity through an empirical approach.

3. As the relative importance of criteria will vary from company to company depending on their business and situation that they are in, the matrix proposal allows for a weighting system to accommodate this.
4. The matrix approach offers a quantitative comparison between potential vendors to assist identify the optimal choice based on the companies needs.

A sample of their matrix criteria with typical weighting can be seen in *Table. 2.3.4.* This would then be used to generate the score card in *Table. 2.3.5.*

GENERAL VENDOR AND PRODUCT CHARACTERISTICS WITH ASSIGNED WEIGHTS

Vendor Characteristics	Assigned Weight	Product Characteristics	Assigned Weight
Service Reliability	20	Price	25
After Sales Service	10	Availability	15
Delivery Time	10	Quality	10
Production Capability	5	Warranty	5

Table 2.3.4 Manzer et al. (1980) Characteristics with weighting.

EVALUATION OF VENDOR A

Evaluation Factors	Factor Weights (W)	Vendor Compatibility Values (V) .0	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	Vendor Scori (W x
Product Price	25							✓					15.0
Service Reliability	20								✓				14.0
Product Availability	15								✓				10.5
After Sales Service	10					✓							4.0
Delivery Timing	10						✓						5.0
Product Quality	10									✓			8.0
Production Capability	5										✓		4.5
Product Warranty	5									✓			4.0
TOTAL	100												VENDOR RATING = 65.0

Table 2.3.5 Manzer et al. (1980) Vendor evaluation score card.

While some more subjective attributes cannot be factored into the matrix the speed and simplicity of the matrix approach offers an effective tool that can play an important role in the decision making process.

Seydel (2005) has identified the paradigm shift to single sourcing, allocating more and more business to fewer key suppliers. This he has attributed to Total Quality Management and JIT manufacturing systems. Seydel in his article (Supporting the Paradigm Shift in Vendor Selection: Multi-criteria Methods for Sole Sourcing) article has highlighted the need for effective multi-attribute decision making tools for vendor selection.

Similar to previous writings Seydel has proposed Price, Quality, Lead-time, Quantity, Delivery, Technology and Service as the seven 7 principle vendor selection criteria. Seydel has proposed that these may be weighted in any way to reflect the needs of the company and identify the most appropriate supplier. The use of simple multi-attribute rating techniques (SMART) or data envelopment analysis (DEA) techniques are then proposed for analysis of results.

Hemaida and Schmits (2006) looked at vendor selection through a case study they carried out at a US engineering firm. The firm carried out large engineering contracts (typically $1 - $15 million), often requiring the fabrication of large dip tanks for coatings. While the firm has capability of fabricating these tanks it not their core business and as routine check step, on acceptance of every contract they will investigate outsourcing this work as a cost saving. Hemaida and Schmits have chosen 4 critical criteria for vendor assessment. These criteria are not new and would feature in some form in Dickson's criteria. They are as follows;

1. Price: This is clearly the principle reason for out-sourcing this work. If it is cheaper to manufacture to the same standard in-house there is no point in outsourcing.
2. Quality: This firm recognises 2 aspects to the cost of quality. The cost of potentially lost business due to poor quality and the cost of rework / repair of defective tanks. A $10,000 cost saving can quickly be eliminated due to a possible $5,000 rework costs and penalties due to project delays.

3. Delivery: Delivery on-time is important in all business but particularly in large engineering projects. Delays in delivery of these tanks can result in overall project delays and as in the case of many contract penalty clauses, additional costs.
4. New Vendor Education: The firm has value highly the way vendors fit into their work and business methods. They put a lot of effort into educating vendors on the needs of the final customer as well as how the firm does business. While vendor with a longer supply history with the firm would be "more educated", in order to maintain a strong pool of potential suppliers the firm makes an effort to educate all new applicants.

As the nature of contracts vary, so too will the relative importance of the selection criteria. While cost and quality are always important, the relative importance of delivery will vary. In the case of projects with compressed timings the relative importance of delivery will increase. With less compressed timings the firm may opt for a cheaper firm with a longer lead time. Similar to Seydel (2005) propose a weighting system to account for the relative importance of the selection criteria. They propose an Analytical Hierarchy Process (AHP) model to factor in relative importance of criteria and the proposed vendors performance versus these criteria.

A great deal of literature published on the subject of vendor selection has focussed on selecting mathematical models to assist in decision making rather than using the correct criteria. Barla (2003) proposed the Multi-attribute Selection Model (MSM) while Masella & Rangone (2000) and Nydick & Hill (1992) favour an Analytical Hierarchy Process (AHP) for making such decisions. Braglia and Petroni (2000) propose the Data Envelopment Analysis model to manage the quality related trade offs in vendor selection. Haq & Kannan (2006) favour the use of Gray Rational Analysis (GRA) using criteria that could be found in Dickson's list in 1966 (Quality, Delivery, Engineering Capability, Service and Price).

2.4 A Regulatory Perspective

In general manufacturing companies have relied on the guidelines of regulatory bodies to define their policy and processes for new vendor selection. In Chapter 3 an analysis of the procedures currently used in industry will qualify this statement. From this analysis it was found that the principle organisations followed have been those of ISO and that of the Global Conference for Harmonisation (a voluntary group of representatives from the pharmaceutical regulatory agencies representing the EU, USA and Japan). This chapter will summarise their perspective on the selection of new suppliers followed by a discussion on their merits.

The **International Standards Organisation (ISO)** has been in existence since 1947 as its name suggests has through various publications and directives established international standards for engineering and the manufacture of goods. In 1987 a series of generic quality management system standards emerged in the form of the ISO 9000 series. This document will focus on those of ISO 9001:2000 Quality Management Systems and ISO 13485:2003 Quality Management Systems and corresponding general aspects for medical devices.

ISO9001:2000 Section7.4.1 requires that companies ensure that purchased products such as ingredients or packaging materials conform to "the specified purchase requirements" in other words the specification. The type and extent of this control is dependent on the material and the effect it has on production and the finished product. Section 7.4.1 goes on to specify the requirement that the organisation "*shall evaluate and select suppliers based on their ability to supply product in accordance with the organisations requirements*". The section requires that the criteria for selection, evaluation and re-evaluation shall be "established" but gives no indications of how. There is also a requirement that all criteria, evaluations and follow up actions be documented and maintained.

Section 7.4.2 requires that in addition to the material specification, where appropriate all handling, process requirements, personnel qualifications, test

methods, equipment and quality management system specifics be documented and shared as a requirement with the vendor. The onus is on the organisation to ensure the "*adequacy of the specified purchase requirements*" before communicating them to potential new suppliers.

Section 7.4.3 proceeds to place the onus on the organisation to "*establish and implement the inspection or other activities necessary for ensuring that the purchased product meets the specified purchase requirements*".

ISO 13485:2003 is effectively the ISO: 9001 document adapted to meet the requirements of the medical device business. With regard to purchasing this document has only one additional requirement, that of material traceability and appropriate maintenance of records. These are statutory requirements for these types of products in most countries.

It is worth noting the following. ISO 9001 and ISO 13485 do not offer...

1. Any criteria for vendor selection other than they must be able to supply materials that meet the requirement of the organisation.
2. Specific measures for the implementation of material specifications other than that they are appropriate for the purpose of the material.
3. Define a method or frequencies for auditing suppliers other than recommend it be documented.

It is clear from the above that ISO does not offer any specific regulations in relation to procurement or vendor selection, it does however offer a well defined generic set of guidelines to run the Quality Management System across a range of businesses. To receive ISO accreditation an organisation requires auditing by an independent accreditation body. The analysis in chapter 3 will demonstrate how many companies use ISO accreditation as a minimum vendor requirement as an opportunity to opt out of carrying out quality audits as part of their vendor selection process.

The **International Conference for Harmonisation (ICH)** is a voluntary group of representatives from the pharmaceutical regulatory agencies and pharmaceutical industries. This group represents the Japanese, US and EU member states pharmaceutical industries, striving to establish common quality, safety and regulation standards to promote open trade. In February 2008 the Global Harmonisation Task Force under the direction of the ICH issued a document "Quality Management System - Medical Devices – Guidance on the control of products and services obtained from suppliers". This document was to merge the US Food and Drug Administration, Japanese ministerial Ordinance and ISO guidelines on the selection and quality management of suppliers of goods and services.

Section 3.2 the document recommends that when selecting potential supplier that they should investigate their business and operational capability. This is to include capability to provide the necessary quality, safety performance and reliability requirements. Section 3.2.1 recognises the importance of the suppliers' business capability acknowledging how their business practices, conduct, reputation and financial viability may be an important indicator of the suppliers' capabilities. This section goes further to highlight how a suppliers' viability may be of particular importance when the company intends to enter a long term relationship with the supplier.

Section 3.2.2 has a focus on the operational capability of the new supplier with emphasis on their "willingness to adapt and respond to performance indicators required" by the company. The document goes further to identify these indicators as including lead times, on-time delivery and response times and may be analysed through past performance expertise, experience and human resources. Other indicators of capability identified include adequacy of manufacturing processes, Information technology and system infrastructure. Objective evidence may be accessed through examination of the product / service portfolio and manufacturing records.

Section 3.2.3 requires that the selection be based on predefined criteria and the results of capability investigations stressing the importance of these criteria being well defined and documented. Section 3.3 highlights that the criteria be in

proportion to the "identified risk of the procured product ... and the effectiveness of the effectiveness/performance of the final product".
Section 3.3 documents the proposed evaluation in 4 steps

- Planning evaluation and documenting selection criteria
- Communication of the requirements with the supplier
- Evaluation of the potential suppliers ability
- Acceptance of the supplier.

It is worth noting that the ICH guidelines

1. Does not include specific measures for the implementation of material specifications other than that they are appropriate for the performance and effectiveness of the material.
2. Does not define a method or frequencies for auditing suppliers other than recommend it be documented.
3. Recognises success criteria other than just quality. These to include lead times, response times, on-time delivery and the financial stability of the proposed supplier.

In summary, the organisations discussed above offer recommendations rather than regulations to guide companies in the vendor selection process. ISO is very process and product focussed but does offer an independent quality accreditation that may be used as a requirement in the new vendor selection criteria. The ICH guidelines thorough the Global Harmonisation Task Force have adopted the ISO guidelines but broadened their scope by recognising the importance of a potential suppliers business and operational capability. While all of the above guidelines are just guidelines and are superseded by statutory requirements that have become recognised as industry standards and as such give potential suppliers a clear vision of what will be required of them.

2.5 Summary

This literature review has shown the strategic changes in manufacturing firms and the greater roles played by suppliers in these firms success. While Porter (1979) recognises the supplier as a competitive force that must be recognised Prahalad and Hamel (1991) have identified selecting the right supplier as an opportunity to build on the firms core competencies. It has been seen how successful firms such as Honda and Wal-Mart have recognised the supplier as playing a key role in their success.

Jagdev & Browne (1998) defined the Extended Enterprise as co-operation on design, development and manufacturing across several independent manufacturing enterprises and suppliers. They have shown how the supplier relationship has moved to having joint ownership for the satisfaction of their joint end customer; they maximise on their respective core competencies and maintain a fundamental level of trust. Childe (1998) brings this concept further when he describes the supplier as becoming part of the principle company and after time become inter-dependent. As this inter-dependency has grown so too has the nature of the relationships with suppliers. An adversarial approach to dealing with suppliers offering short contracts for the lowest price has moved to long term relationships where mutual success is important and each participant capitalises on their respective core competences.

As the role of the supplier moved from that of an external entity to being a strategic partner in the extended enterprise the importance of selecting the right supplier has become much greater. When selecting new suppliers it is important that firms ensure that the new supplier bring the appropriate competencies and are a good strategic and cultural fit before embarking on a long development or manufacturing project.

Much of the published literature on supplier selection has focussed on mathematical models that may be used for decision making rather than identifying the best criteria for supplier selection. These models (DEA, AHP, GRA etc.) provide mathematical solutions to analysing multiple and sometimes conflicting variables.

Weber (1991) has listed Dickson's 23 vendor selection criteria, first published in 1966 and examined their relevance in 1991. Through a literature review he has rearranged them in new priorities based on the number of articles citing these criteria. It is worth noting that the relevance of price has increased significantly. The advent of JIT manufacturing is also very evident as Dickson's "Geographical location" which we now call lead time has become more important due to attempts to reduce inventory. While other authors have published work on vendor selection criteria nine are significantly different to those published by Dickson in 1966 and principally revolve around price, quality, capability and reliability of delivery. Through the review of material published on vendor selection criteria little has been done to apply empirical metrics to these criteria, they have mainly taken the form of a subjective weighted score card.

A review of ISO and ICH guidelines has done little to identify the critical criteria for vendor selection. These regulatory bodies have been clear in placing the onus of the firm that it is their responsibility to ensure suppliers ability to supply goods or services to meet the appropriate requirements but do not suggest how. It has been shown that ISO has been very product quality orientated while ICH has recognised that the supplier must also meet some business driven criteria. In vendor selection these organisations have been most useful in their accreditation role. Many organisations identify these ISO and FDA accreditations as a minimum quality requirement in their vendor selection criteria often using this also as excuse not to carry out an audit at potential new vendors.

Chapter 3: Context

3.1 Introduction

To provide some context the following is a summary of procedures currently used by a selection of companies of different size and business manufacturing in Europe. The companies willing to share their processes have only done so with the understanding that confidentiality is guaranteed. For this purpose all companies will be referred to by letters (A, B, C, etc) and a brief description of the company size and the business that they operate in.

To facilitate an easy comparison between companies all company procedures have been summarised into a standard template. In addition to a brief introduction to the company their vendor selection policy has been examined under the headings of

1. Corporate and Social responsibility, reviewing what criteria (if any) have been applied to vendor selection.
2. Quality: What quality metrics (if any) are been applied to vendor selection.
3. Finance: What financial metrics (if any) are been applied to vendor selection.
4. Logistic: What logistic / supply chain management metrics (if any) are been applied to vendor selection.
5. Innovation: What Innovation metrics (if any) are been applied to vendor selection.

A final discussion at the end of each company's summary will review the overall selection process and attempt to identify the rationale driving the selection of each set of criteria.

3.2 Review of current Practices

Company: A

Company Type: US Multinational

Business: Fast moving consumer goods

Annual Turn-over: not available

Number of Employees: 135,000

Procedure Format: Internal SOP

Corporate and Social Responsibility:

While there are no specific references to CSR in the vendor selection material all employees within the organisation must sign the company's business conduct policy. The business conduct manual details the company's ethical policy on all transactions with external businesses.

Quality:

This procedure contains extensive detail on quality. This has been copied directly from the company's internal quality manual. This details quality in 19 Key elements ranging from leadership through starting materials, release of finished product and product traceability. This is not unlike the ISO 9001 standard. In addition to quality a manufacturing section replicates many of the quality elements such as Facilities, SOP's and Training.

Financial:

As a US multinational the company uses the D&B PAYDEX service to evaluate potential new vendors. Typical expectation is that the Vendor has a rating of 4A minimum indicating a balance sheet value of 10 to 50 million dollars. Corporate governance is discussed but without the application of clear metrics.

Logistics:

The document discusses ERP applications for inbound/outbound logistics and Inventory management but without any metrics applied. In a similar way communication protocols such as EDI are discussed but without metrics applied. The only metric in this section is where the target and actual % of on time good quality deliveries are measured V's orders placed.

Innovation:

Project management and R&D are discussed with reference to written procedures, IT systems, scale-up capability and pipeline of future developments but without clear metrics. A willingness to invest in technology is also discussed but without any measures.

Discussion:

This procedure covers 56 criteria with a lot of duplication. Many criteria are very subjective and lack clear metrics. There are very few criteria that have clear metrics that may be used for direct comparisons. As this is a large resource intensive process it is generally only used when sourcing larger suppliers, this is determined by spend value.

Company: B

Company Type: Multinational Franchise PLC

Business: Manufacture and Retail of cosmetic and Beauty care products.

Annual Turn-over: not available

Number of Employees: not available

Procedure Format: Questionnaire to be completed by the potential vendor.

Corporate and Social Responsibility:

This company has a very detailed section on Ethics. The document determines the presence of an ethics committee, written employment policy and health and safety policy. The employment policy is reviewed in detail with 29 questions ranging from minimum age to grievance procedures. Other features of CSR such as Environmental policy and animal rights policies are also an area of focus, investigating lobby group membership and use or planned use of alternative energy sources.

Quality:

The document determines if the vendor has ISO9001 or if any other independent Quality Management System in place. The document determines what processes are carried out within the organisation and those that are contracted to other vendors and establishes the control and traceability throughout the manufacturing process. The document goes on to establish what (if any) statistical techniques are in place.

Financial:

The financial section identifies 3 clear metrics, annual turnover, Gross Profit and Return on Investment over the past 5 years.

Logistics:

The document questions the location and capacity of manufacturing and warehouse facilities. This document follows on to question the presence and type of MRPII system in place. There are no metrics for any of these criteria. The only Logistic metric in place is that of lead time from, placement of order.

Innovation:

There is no reference to Innovation or change management through out the document.

Discussion:

This organisation manufactures and retails beauty care products in 61 countries. This organisation has differentiated it's self from competitors through promotion of its social and corporate responsibility. Corporate and Social Responsibility features highly in the criteria for new vendor selection this is followed closely by quality systems.

Company: C

Company Type: US Multinational PLC

Business: Generic Pharmaceuticals

Annual Turn-over: $5.14 Billion

Number of Employees: 15 000

Procedure Format: Internal SOP

Corporate and Social Responsibility:

The document does not make any reference to Corporate and Social responsibility.

Quality:

This document has an extensive quality section which is very closely linked to international regulatory standards. The document establishes if the vendor has been assessed by accredited certification bodies and the presence or plans to introduce ISO9001.

The document establishes the presence of calibration, validation and product traceability procedures through out the manufacturing and material supply chain. The document queries how processes changes are introduced and how these are communicated to the customer.

Compliance to International standards (ICH and EU) standards relating to VOC's and BSE are also investigated in this document.

Financial:

The document does not make any reference to the Financial stability of potential new vendors.

Logistics:

The document does not make any reference to logistics or supply chain management.

Innovation:

The document does not make any reference to R&D or Innovation.

Discussion:

This company operates in a very tightly regulated business environment. All vendors must comply with international and legally binding standards. These are primarily ICH (International Conference for Harmonisation), FDA and EU guidelines. This limits the field of potential vendors significantly. For generic pharmaceutical materials it is very difficult to be innovative as all any changes require costly and time consuming validations.

While logistics are a concern regarding excess inventory and expiry dates it is not considered as critical as it would be in the fast moving consumer goods industries.

The document focus is on compliance with industry regulations rather than real measures to measure the performance of potential suppliers.

Company: D

Company Type: UK Subsidiary of US Multinational

Business: Plastic packaging for food and cosmetic industries.

Annual Turn-over: £19 million

Number of Employees: 150

Procedure Format: Questionnaire to be completed by the potential vendor.

Corporate and Social Responsibility:

This document has an extensive section on Environmental policy. This ranges from the policy to ISO14001 and environmental impact studies. The document requires information on the environmental policies and training within the vendor's organisation. The document required the vendor to detail the materials the vendor uses and how any waste is disposed of. The document asks how the vendor measures environmental performance but does not include key measures.

Quality:

The document determines if the vendor has ISO9001 or any other independent Quality Management System in place. The document determines what processes are carried out within the organisation, establishes the control and traceability of product throughout the manufacturing process. The questionnaire goes into further detail regarding training, Good Manufacturing Practice and product recall protocols.

Financial:

The document does not make any reference to the Financial stability of potential new vendors.

Logistics:

The document does not make any reference to logistics or supply chain management.

Innovation:

The document does not make any reference to R&D or Innovation.

Discussion:

Company D requires vendors to furnish the above details as part of a self assessment process. The focus on environmental policies is typical of a recent trend in organisations supplying plastic packaging. When interviewed Company D indicated that in most cases the raw materials and vendors are specified by the customer. The environmental and quality details required to satisfy Company D's quality and environmental procedures.

Company: E

Company Type: Irish Subsidiary of US Multinational

Business: Thermoform packaging for Pharma. and Electronics industry

Annual Turn-over: not available

Number of Employees: 60

Procedure Format: Questionnaire to be completed by the potential vendor.

Corporate and Social Responsibility:

The document does not make any reference to Corporate and Social responsibility.

Quality:

This document takes the format of a self assessment questionnaire that links directly to ISO9001:2000 assessing criteria such as..

Resource Management ISO9001:2000 SECTION 6.2

Product Realisation ISO9001:2000 SECTION 7

Infrastructure and work environment ISO9001:2000 SECTION 6.3 & 6.4

PurchasingISO9001:2000 SECTION 67.4

Validation & Calibration ISO9001:2000 SECTION 7.3.5, 7.3.6 & 7.6

Product Preservation ISO9001:2000 SECTION 7.5.5

Financial:

The document does not make any reference to the Financial stability of potential new vendors

Logistics:

The document does not make any reference to logistics or supply chain management.

Innovation:

Other than change management and validation (ISO ISO9001:2000 SECTION 7.3.5, 7.3.6) there is no reference to Innovation in this document.

Discussion:

Company E requires vendors to furnish the above details as part of a self assessment process. Following submission of the self assessment form an audit is carried out by the QA department. While this is the only document used to assess potential new vendors the Company E does have an extensive vendor management SOP. The vendor management SOP details a process for rating and awarding their best suppliers using criteria such as Delivery, Quality, Cost and Responsiveness.

Company: F

Company Type: German Subsidiary of German Multinational

Business: Plastic packaging for food and cosmetic industries

Annual Turn-over: not available

Number of Employees: 250

Procedure Format: Questionnaire to be completed by the potential vendor.

Corporate and Social Responsibility:

Other than determination of corporate ownership of the vendor the document does not make any reference to Corporate and Social responsibility.

Quality:

The document determines if the vendor has ISO, DIN or any other independent Quality Management System in place.

The document requires input as to the management structure and how quality is managed throughout the organisation. The document proceeds with a series of yes/no questions regarding procurement, product identification and traceability, process control and training. The questionnaire goes further to cover handling non-conformities and corrective measures using terminology very similar to that of ISO9001:2000.

Financial:

The only financial input into this document is that of ownership and annual sales turnover.

Logistics:

Other than the question of "First in –First out" stock management being in place the document does not make any reference to logistics or supply chain management.

Innovation:

Other than the question "Does the organisation have a development department" there is no reference to Innovation in this document.

Discussion:

Company F uses a self assessment questionnaire which is highly reliant on the established industrial standards. This company is highly innovative with a high degree of expertise and IP in packaging and dispensing. When asked of the effectiveness of this questionnaire they freely admitted that the procedure was in place to meet ISO standards. They went onto point out that they valued the relationship with their vendors very highly and that they can identify the vendors they wish to deal with from the first face to face meeting.

Company: G

Company Type: US Multinational

Business: Packaging for Food, Pharmaceutical and Cosmetic industries

Annual Turn-over: $6.6 Billion

Number of Employees: 23000

Procedure Format: Questionnaire to be completed by the potential vendor.

Corporate and Social Responsibility:

In addition to determination of corporate ownership of the Company the questionnaire proceeds to determine the location of the manufacturing sites. The document then determines if these sites are unionised, the minimum age of workers and the rate of employee turn-over. The document then requests a break down of the labour force into skilled and un-skilled. The document then questions the facilities with regard to health and safety from Air conditioning to fire escapes.

Quality:

The document determines if the vendor has ISO or equivalent Quality Management System in place.

The document requires input as to the management structure and how quality is managed throughout the organisation. The document proceeds with a series of yes/no questions regarding procurement, product identification and traceability, process control and training. The questionnaire goes further to cover handling non-conformities and corrective measures.

Financial:

The only financial input into this document is that of ownership and annual sales turnover.

Logistics:

Other than the question of "First in –First out" stock management being in place and warehouse security the document does not make any reference to logistics or supply chain management.

Innovation:

This questionnaire questions in detail the innovative capability of the vendor from design and CAD capability through to prototyping and tool construction. This also determines the availability of English speaking design engineers.

Discussion:

Company G is a very large multinational company with a considerable presence in Asia. With many western blue chip customers it has placed a focus on social responsibility most likely due to similar pressures from their customers. The company uses a self assessment questionnaire which is highly reliant on the established industrial standards. This company is highly innovative with a high degree of expertise and IP in packaging and dispensing. .

3.3 Summary

From the examples above and follow up conversations with the 6 companies the following points are evident.

1. For most organisations these processes have been created only to meet commitments in their quality manual or quality requirements of independent accreditation boards. As a result of this the procedure has a strong quality focus with many criteria taken directly from ISO9001:2000. This leads to a high dependency on independent industry standards rather than looking at the specific needs of the organisation.
2. Conversations with many of the companies have indicated that the relationship with their suppliers is highly valued and first impressions from face to face meetings generally supersede any formal analysis.
3. Many of the companies have relied on the potential vendor to complete a questionnaire which may or may not be followed up with an audit.
4. All companies have some form of vendor management system or supplier scorecard which uses measures such as % on time deliveries and % quality defects.
5. In almost all cases criteria are attributes rather than variables that can be measured and compared. For example the presence of an MRPII system does not necessarily mean it has been effectively implemented and as a yes/no result does not allow for comparison between 2 companies who both have MRPII systems.
6. In highly regulated industries such as pharmaceuticals and medical device manufacture the selection of vendors is constrained by independent accreditations and costly validation requirements. This reduces the scope to change supplier. Potential competitive advantages of cost, quality or lead time may be off-set by the time and expense required to validate a new vendor.

7. Company A is the only example where there is a full vendor selection process lead by Purchasing with formal inputs from other functional groups. In most cases vendor selection is owned by Purchasing with informal inputs from other functional groups. The criteria indicated in the examples above are only used to formally approve the selection.

In summary from the limited number of examples above many organisations use their vendor selection processes as a stage gate to "rubber stamp" the decision to add a new vendor to their Approved Vendor List. The processes are highly reliant on established industry standards and do not focus on the individual needs of the organisation.

Previous sections of this document have identified the importance of having good suppliers. All of the above companies agree with this principle and depending on the nature of goods and services supplied view these suppliers as business partners. Many have insisted that a face to face meeting is of greater value than the "paper exercise" of a vendor assessment form. In most cases the process is owned by purchasing with a lack of transparency in the final decision making criteria.

It is evident from all of the examples above that the selection criteria in use lacks clear metrics and are generally not specific to meet the companies' individual needs.

Chapter 4

"A Proposed set of KPIs for new vendor Selection"

4.1 Introduction

Having examined the approach of regulatory bodies, those in published articles and the current approach to new vendor selection adopted by a sample of real manufacturing companies, this document will proceed to propose a set of Key Performance Indicators to be considered when selecting new vendors.

Many organisations have specific success criteria that are not true variables that may be measured and used when comparing new vendors. Success criteria such as ISO:9001 accreditation, Pharmaceutical Manufacturing License or implementation of an MRPII system may be an absolute requirement for some companies but are not true metrics and will remain outside the scope of this document. This document is limited to Key Performance Indicators that may help in the decision-making process to identifying the potential vendor that best meets the company's needs.

The following proposed KPI's originate from the experience of the author, conversations with other companies and the published works of other authors.

4.2 The Proposed set of KPIs for new vendor Selection

These may best be examined in 4 main groups.

1. **Financial**: Measuring cost of components and the financial performance of the vendor.
2. **Quality**: Measuring how the vendor manages quality within their organisation.
3. **Logistic**: Measuring the logistical performance of proposed new vendors.
4. **Innovation**: Measuring the less tangible aspects of a new vendor such as Investment in R&D and Intellectual Properties such as patents and know how.

Financial Key Performance Indicators:

Material cost, payment terms and the financial stability of the company are of great concern when selecting a new vendor.

KPI 1: COVER FOR CREDITORS

The importance of the financial stability of company's suppliers can not be underestimated. Earlier sections of this thesis have highlighted the importance of material suppliers as partners and as part of the extended enterprise.

In many cases the appointment of the new vendor is followed by a large investment of time and money in design and qualification of equipment or tooling. This tooling is generally designed to fit the needs of the vendor's equipment and often cannot be transferred to another vendor without considerable technical challenges. In the case of transferring or creating new printed packaging at a new supplier, high investment in new artworks, print plates and die cutters is not unusual. It is for this reason that is important to be confident that the vendor is still in existence and trading once the investment is complete.

It is essential that vendors provide a consistent supply of materials. If the vendor is not financially stable, cash flow (and material flow) and possible closure will of course affect the material supply. The net effect of this scenario is loss of investment costs when transferring business to this supplier and an interrupted supply of materials. The failure of material supply not only results in loss of revenue from orders not filled but more importantly loss of future sales due to disappointed customers.

The current global credit crunch has resulted in many companies go out of business due to credit and cash flow issues. These closures usually occur with very short notice to their customers. For these reasons it is essential that a measure be put in place to ensure a new vendor can pay its bills and remain in trading in the medium to long term.

Many organisations use the acid test or liquidity ratio (current assets-stock/current liabilities) to determine the liquidity of a company. Mills and Robertson (1999) suggest that this is over simplistic and does not consider bank

overdrafts that may be in place. Bank overdrafts can correctly be used to buy stock but this will not be reflected in the Acid test ratio. Mills and Robertson propose "Cover for creditors" as a more effective measure of the liquidity of a company.

Cover for creditors = Current Assets-Stock-Bank Overdraft / Trade Creditors

While the financial nature of business varies and experts differ on a minimum target for this ratio it does provide a good tool to compare similar companies and highlight any causes for concern

KPI 2: MATERIAL UNIT COST

While the competitive advantages of low cost materials are obvious it is essential that all vendors are measured against the same standard. Organisation A discussed in the previous section has identified many potential cost savings by sourcing packaging materials from lower cost economies such as India and China. While the reduction in piece price may be of benefit it can be greatly outweighed by the prohibitively high cost of transporting bulky low value goods. Other factors such as minimum order quantity, lead time and forecast volumes will have an effect on the material unit price. It is essential that all vendors quote prices for the same volumes, logistical constraints. Even where materials are quoted at an ex-works rate the vendor must be assessed on the cost of materials delivered to the plant.

KPI 3: NUMBER OF DAYS CREDIT

The credit terms offered by vendors can have a direct effect on cash flow. Longer credit terms allow the opportunity to convert materials into finished products and then into cash before paying for these materials. This is not usually the case with typical credit terms of 30 days from delivery. Many larger retail chains demand much longer credit terms often 90 days gaining revenue by investing the cash over this extended time.

The typical credit terms in manufacturing do not allow for new revenue streams but may drive the need for bank overdrafts to maintain cash-flow. Overdraft interest costs directly affect the net profit of the company. In summary better credit terms allow for a much improved cash flow which may directly affect the company's net profit.

Quality Key Performance Indicators:

"*In many companies the cost of purchased materials, parts and services is over 50 percent of the manufacturing costs of the company. Thus the overall programme for quality in a company must extend to the vendors (or suppliers) from whom the purchased are made*." Duran (1982)

The importance of quality starting materials can not be over stated. Poor quality materials result in poor quality finished product, increased waste and poor process reliability. These factors have a direct negative effect on the success and profitability of a company.

As discussed in previous chapter's accreditation bodies such as the FDA and ISO have issued guidelines towards quality management systems but have not documented any clear quality metrics. Two consistent themes throughout the literature are that of quality measurement and continuous improvement. It is for this reason that one should expect potential vendors to have the following measures already in place and be in a position to share this data.

The effectiveness of the quality management system can be best measured by the number of complaints, the speed at which complaints are addressed and the number of repeat complaints.

KPI 4: NUMBER OF CUSTOMER COMPLAINTS

To treat all potential vendors equally quality complaints are best measured as the number of complaints versus the number of lots delivered. This allows for the fact the some vendors may have more complaints due to more deliveries. Failure of the vendor to have this information readily available should be a

cause for concern. The lack of customer complaints may indicate a failure to record, track and address customer complaints.

Annual Number of customer complaints / Number of Deliveries per year

KPI 5: % COMPLAINTS ADDRESSED WITHIN AGREED TIMINGS

To have any confidence in a vendor it is essential that complaints are addressed and corrective actions put in place in a timely manner. Most supplier contracts or site level execution agreements detail the format and timings of complaint responses. The timings are typically 7 to 21 days with extended time available where fixes may take more time or require capital investment. For a quality management system to be effective it must have the ability to track the management of customer complaints.

Number of complaints addressed on time / Number of Complaints x100

KPI 6: % REPEAT COMPLAINTS

Repeat complaints are successive deliveries found to have the same quality defects. The effectiveness of complaint responses and corrective actions are best measured by the number of repeat complaints received. A high percentage of repeat complaints indicate in effective and quality management system that has not implemented a quality continuous improvement programme.

Number of repeat complaints / Total number of Complaints x100

Logistic Key Performance Indicators:

"The importance of time as a competitive weapon has been recognised for some time. The ability to be able to meet the demands of customers for ever-shorter delivery times, and to ensure that supply can be synchronised to meet the peaks

and troughs of demand , is clearly of critical importance in this era of time based competition" Christopher (2000) p.37.

The Toyota Production System, Just In Time manufacture and Lean Manufacture Methodologies have had a profound effect on manufacturing over the last 30 years. These developments brought demand driven, flexible production delivering value to the customers. These methodologies all drive the concept that factories are not warehouses and as such should not carry large inventories. Large inventories cost money in tied-up capital, storage space and often lead to obsolescence costs.

In order to meet customer demands a greater variety of products are needed, in smaller quantities and with ever decreasing notice. The customer recognises the cost of inventory too! The need to be responsive to fluctuating customer demands while maintaining low material and finished product inventories calls for an agile supply chain. Materials Resource Planning (MRP), Electronic Data Interchange (ERP) and computer applications such as SAP have facilitated this trend in supply chain management but are not success measures that may be applied to selection of new vendors. Modern manufacturing requires material delivered on-time, with the shortest possible lead time and at the most flexible quantities (i.e. lowest Minimum order quantity).

KPI 7: % DELIVERIES ON-TIME

As manufacturers reduce their inventories of raw materials the concept of on-time delivery has become more and more critical. Often manufacturing plants hold only a few days' material stocks. Without the buffer of a large stock of raw materials a delay in delivery of materials can result in lines shutting down due to lack of material and missed commitments to the manufacturers' customers. Reliable deliveries are critical. A key measure that should be tracked at all vendors is ..

$$\frac{\text{Number of on time deliveries}}{\text{Total number of deliveries}} \times 100$$

KPI 8: LEAD TIME

The demand driven supply chain requires a flexible production plan that requires materials to meet this plan in the shortest time possible. The time from placement of the materials order to delivery is known as lead time. Vendors that require longer lead times will become a constraint on the manufacturers' production schedule and hinder responsiveness to the customer's demands.

Number of days from placement of order to delivery

KPI 9: MINIMUM ORDER QUANTITY

KPI 2 identified the material cost as an important factor when selecting a new vendor. It is essential that when analysing proposed vendors prices that the minimum order quantity is considered. Through economies of scale such as reduced set-up costs suppliers can offer materials at discounted prices for larger order quantities. Larger order quantities will increase the manufacturer's inventories and due to changing customer demands may result in material expiring or becoming obsolete. The cost of the high inventory and risk obsolescence must be considered when agreeing a minimum order quantity with the supplier. This can be best measured as a percentage of the annual forecast volume.

Minimum Order Quantity / Annual Forecast Volume x100

Innovation Key Performance Indicators:

In the literary review the supplier has been described as part of the Extended Enterprise and as a Strategic Business Partner. Conceptually Childe (1998) has pointed out that through the extended enterprise paradigm suppliers have become part of the business and "*can no longer be regarded outside the principal company's affairs*". He goes on further to describe the idea of "*Co-makership*" allowing company and supplier to work together on value engineering driving quality improvements and cost reductions for both parties. Innovative suppliers can offer companies a competitive advantage through being first to market with newest materials, designs packaging or components.

In some cases the selection of a specific vendor may be driven by the need for a specific Intellectual Property such as a material, patented technology or know how. This document will focus on using innovation as a measure to identify better suppliers. Innovation is often considered to be an abstract concept that is difficult to measure. If innovation were considered as a simple process with inputs and outputs it may be measured with less difficulty. The key input into innovation must be resources in training and R&D. The typical outputs of innovation are new products and intellectual property.

KPI 10: % GROSS PROFIT INVESTED IN R&D ANNUALLY

A good measure of the regard a potential has for innovation is to quantify their annual investment in R&D. This can be expressed as a percentage of gross profit.

$$\frac{\text{Annual Investment in R\&D}}{\text{Annual Gross Profit}} \times 100$$

KPI 11: % ANNUAL SALES DERIVED FROM NEW PRODUCTS

A key output of innovation must be new products. As materials, technologies, regulations and customer demands change faster and faster, product lifecycles become shorter and shorter. The number of new products (less than 5 years old) is a good indicator of how innovative a company is, this can be best be measured as a percentage of total sales.

$$\frac{\text{Annual Sales from new products}}{\text{Total Annual Sales}} \times 100$$

KPI 12: IP VALUE AS A % of COMPANY VALUE

Another output of innovation is that of Intellectual Property. Intangible assets such as Patents, Know-how and the supplier's reputation may also greatly influence the supplier selection but cannot be measured through the number of new products it owns. The quantity and value of IP owned by a company can be a measure of its innovativeness. IP may be measured as a percentage of the overall company value. These intangible assets are best calculated as the market

value of the company less the book value which is the sum of current and fixed assets. This mat be calculated as a percentage as below..

Value of IP (Market value - Book value of company) / Book value x100

4.3 Summary

In summary the following are the proposed by the author as the most appropriate measures to be used in assessing potential new vendors. Through the use of an e-mail survey these proposed Performance indicators will be evaluated by a panel of approximately 60 individuals representing the various functional groups in manufacturing.

Description	Measure
1. Cover for creditors	Current Assets-Stock-Bank Overdraft / Trade Creditors
2. Material unit cost	Unit Cost / Benchmark cost x 100
3. Days credit	Number of days credit from delivery of goods
4. Customer Complaints	No. complaints / No. deliveries per year x 100
5. Complaint Responses	No. complaints addressed on time / Total No. Complaints x 100
6. Repeat Complaints	No. repeat complaints / Total No. Complaints x 100
7. Deliveries on time	Number of on time deliveries / Total number of deliveries x100
8. Lead Time	Number of days from placement of order to delivery
9. Min. Order Quantity	Minimum Order Quantity / Annual Forecast Volume x100
10. Investment in R&D	Annual Investment in R&D / Annual Gross Profit x100
11. Sales from New Products	Annual Sales from new products / Total Annual Sales x100
12. Value of IP	Value of IP (Market value - Book value of company) / Book value x100

Table 4.3.1 Summary of Proposed Measures

Chapter 5: Research Methodology

5.1 Introduction

The purpose of this research is to gain an understanding of the current approaches taken by industry to select new vendors and to propose an effective series of metrics that may be used in this process. This chapter will define the research methodologies used in the study, explaining the two primary research questions the rationale behind the survey group selection and survey method. The methodology used in this thesis has been sourced primarily from the book "Research Methods for Business Students" by Saunders et al. (2007).

5.2 Research Approach

Saunders et al. (2007) suggest that research may be theoretical or empirical. In the literature review the empirical study carried out by Dickson (1966) was contrasted to that of the Weber (1991) study which was theoretical based only on the academic articled published on this subject. This research will take the empirical approach to gain a quantitative analysis of individual's involvement and opinions regarding new vendor selection. For the purpose of this research e-mail surveys have been used.

In 1966 when Dickson carried out his survey, the selection of suppliers was very much the sole decision of the purchasing manager. In view of this his survey population was comprised of 273 purchasing agents / managers. In the 43 years that have elapsed since the Dickson survey new manufacturing methodologies such as JIT, TQM and WCM have widened the responsibility of new vendor selection to many other functional groups in manufacturing.

The survey group in this research is comprised of 78 individuals all employed in manufacturing companies. Their business includes manufacture of pharmaceuticals, medical devices, cosmetics, consumer goods and consumer packaging. Brewing and contract manufacturing are also represented. 90% of the companies are multinational with 55% of these having a manufacturing

presence in Ireland. The individuals represent the 5 primary functional groups of Sales/Customer Service, Quality Assurance, Logistics/Operations, Technical and Purchasing. While it is important to focus on the Purchasing contributors as they have the greatest responsibility in vendor selection it is also important to recognise the contribution of other stakeholders in the organisation.

Saunders et al. (2007) also suggest that research may be longitudinal or cross-sectional. Longitudinal research generally extends over several years monitoring and analysing change in one organisation over time. This type of research is more suited to that of a doctoral programme rather than the limited duration of the masters' degree. It is for this reason that a cross-sectional approach has been taken. This research will offer a snap shot of the current approached to vendor selection over a range of organisations. The merits of this choice will be discussed further when discussing the limitations of the research in Chapter 7.

5.3 The Survey

The survey is best described as a self-administered questionnaire shared via e-mail. As people tend to access their own e-mail these have a greater probability of response from the people that they have been addressed to than those administered by post. Respondents of self-administered questionnaires are less likely to try to please the researcher with socially desirable responses than those administered by the researcher face to face or via telephone (Sanders et. al., 2007, p.359). The author also recognises that the risk of data contamination is also higher as the contributor has a greater opportunity to discuss responses with colleagues. To avoid survey fatigue and increase the response rate the questionnaire has been designed that it may be completed in 10 to 15 minutes. As this is an empirical study the contributors have been invited to assign numeric values to criteria or use a Likert evaluation scale to which values will be added during evaluation. A comment box is also available for those that wish to elaborate on their opinion. The survey group have been invited to offer their expert opinion rather than their company's official policy on vendor selection. Total confidentiality of the responses has been assured.

This survey will attempt to answer 2 Primary questions.

1. What is the attitude and degree of involvement of individuals within manufacturing companies in new vendor selection?
2. Which of the proposed metrics are regarded as most important by individuals within manufacturing companies and how useful are these metrics?

To answer these questions a series of secondary questions have been devised for the survey and as discussed below.

Primary Question 1

"What is the attitude and degree of involvement of individuals within manufacturing companies in new vendor selection?"

Having established the current approach of industry to vendor selection through the examination of the procedures used by seven different companies, this research will proceed to examine the opinion and involvement of a selection of professionals in manufacturing industries towards vendor selection.
Through a survey of 8 closed questions the research expects to establish the following:

1. The role (Functional group) of the respondent in industry.
2. The degree of process involved in vendor selection within the individuals company.
3. The individual's role in the selection of new vendors.
4. The individual's opinion of the role of the vendor in their companies business.
5. The individuals concerns for the financial stability of vendors.
6. The individuals concerns for vendors quality.
7. The individuals concerns for material supply logistics.
8. The individuals concerns for the innovativeness of new suppliers.

Q1 will establish the functional group the survey contributor operates in. This survey group has been selected from a range of manufacturing functional groups from Purchasing through to QA. This data will help to understand the differing views of the various stake holders in vendor selection. This data will also be used in a similar manner when examining the results in the second part of the survey.

Q2, 3 and 4 will attempt to establish the attitude and roles of individuals within their company's to vendor selection and the concept of the Extended Enterprise. In the literary review the importance of suppliers has been highlighted and the role of all stakeholders in their selection. In addition to determining the individuals participation in vendor selection through cross referencing with Q1 it will be possible to determine the involvement of the various functional groups in this process.

Q5, 6, 7 and 8 will determine the vendor criteria most valued by the individuals. These criteria will include Cost, Logistics, Quality and Innovation. As previously through cross referencing with Q1 responses it will be possible to determine which of these vendor criteria are of greatest value with each functional group.

Questions 2 to 8 are rating questions where the respondent may agree or disagree with the statements offered to varying degrees. This is known as Likert-style rating scales (Sanders et. al., 2007, p.372) where the contributor may strongly agree, agree, neither, disagree or strongly disagree with the statement. During analysis these will be given numerical values where "strongly agree" will be given a value of 2 running down to "strongly disagree" will be given a value of -2. On a qualitative level the respondent may add comments after each question. This is not compulsory but any comments will be considered in the data review.

See Appendix I for copy of the survey "Primary Question 1".

Primary Question 2

"Which of the proposed metrics are regarded as most important by individuals within manufacturing companies and how useful are these metrics?"

Having proposed a set of 12 measures for vendor selection in Chapter 4, the second primary question will establish their acceptability to professionals within the manufacturing industry. The survey requires the contributor to evaluate the proposed measures and to score these accordingly ranking the 12 measures. The contributors have been asked to award 12 points to the metric that they consider most important and so in decreasing value to 1 point for the value they consider least important. This is similar to the work carried out by Dickson in 1966. The number of criteria has been reduced from 23 to 12 and the population in the survey reduced from 273 to 78.

This survey uses the same survey population as section 1 and so it will be possible to identify the functional groups individuals operate in. In this way it will be possible to determine which metrics will be of greatest value to each functional group. A final question will request the contributor to evaluate usefulness of these measures as a whole giving them an overall score from one to ten and invites any additional comments.

See Appendix II for copy of the survey "Primary Question 2".

5.3 Summary

This research is best described as a Cross-Sectional and Empirical study. The research will use an e-mail survey to answer 2 primary questions regarding attitude and degree of involvement of individuals in new vendor selection and the value of the new vendor measures proposed in Chapter 4. The survey population of 78 includes individuals from various functional groups across a range of manufacturing businesses. The survey has been designed to take as little time as possible to complete and seeks the individual's professional opinion rather than that of their company. The results of this survey will be reviewed and tabulated in the next chapter.

Chapter 6: Results Review and Analysis.

6.1 Introduction

Of the 78 individuals surveyed 59 responded, this represents a response rate of approximately 76%. 28 of the respondents offered an opinion through completing at least one of the comments boxes in Survey 1. No contributor completed all comment boxes. A summary of the survey group and the survey responses are available in appendices B and C. The break down of respondents' roles may be seen below in *fig. 6.1.1.*

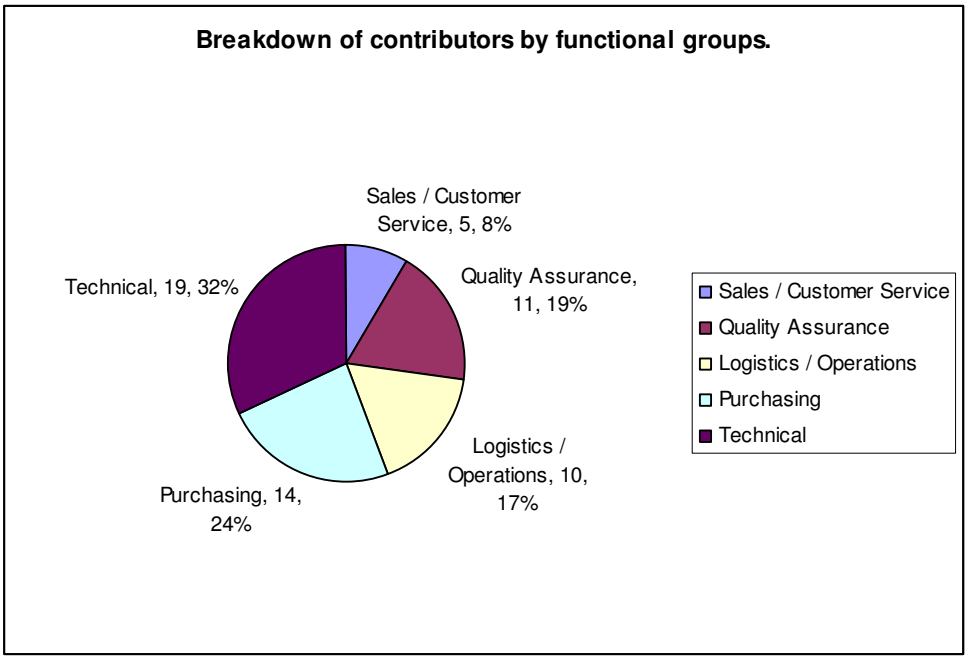


Fig. 6.1.1: Breakdown of contributors by functional group.

The respondents primarily represent 3 main business sectors that of fast moving consumer goods, packaging (Pharma. and Cosmetic) and the medical Device / Pharmaceutical industries. The 9 remaining others represent government departments, engineering forms and 1 brewery.

The break down of respondents' by business sector may be seen below in *fig. 6.1.2.*

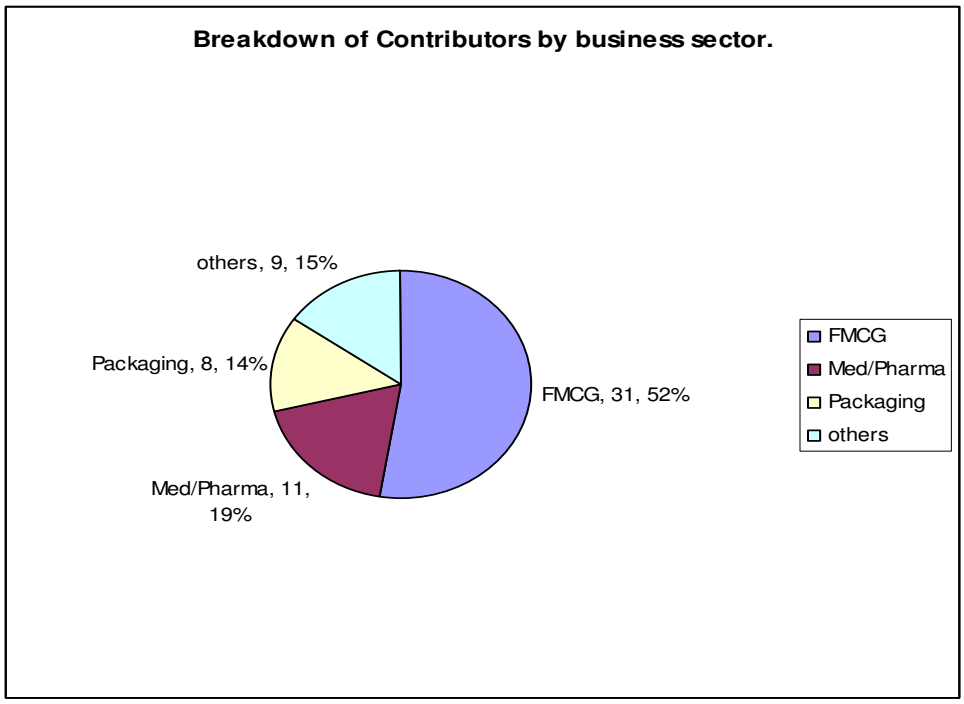


Fig. 6.1.2: Breakdown of contributors by business sector.

This chapter will review and attempt to analyse the data attained from the 2 surveys described in the methodology.

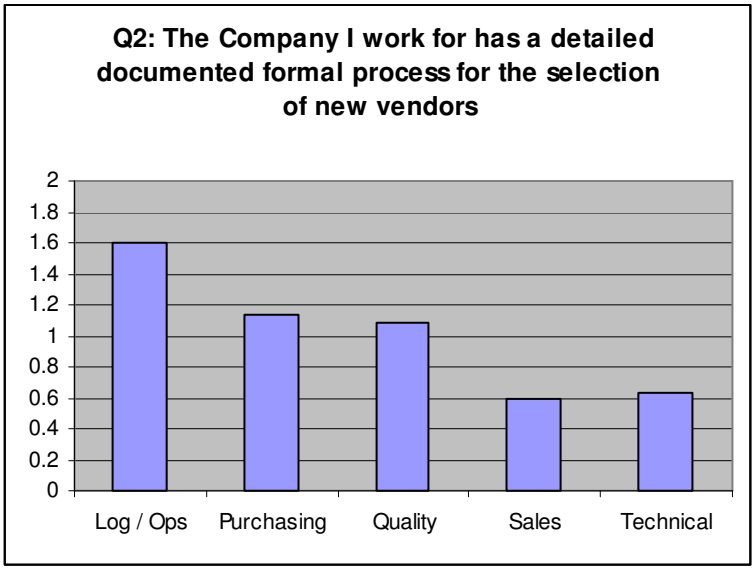
Section 6.2 will analyse the responses from each of the 7 questions in questionnaire 1 while relating them to the roles / functional groups responding. In addition to recording an average score the standard deviation has been calculated. The small sample size in some instances will limit the relevance of the standard deviation as a statistical tool but will prove of some use as an indicator of the lack of census among some respondents. The results will also be presented in standard bar graph from. Any relevant comments will also be highlighted.

Section 6.3 will analyse the data from questionnaire 2 in an attempt to determine what the survey population consider the most useful measures when selecting new suppliers. This section will also review any comments given on the usefulness of these measures as a vendor selection tool.

Section 6.4 will summarise the results.

6.2 Review of Questionnaire 1 Data

Question 2: "The Company I work for has a detailed documented formal process for the selection of new vendors"



Q2	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1.6	1.14	1.09	0.6	0.63
sd	0.52	0.95	0.83	0.55	1.38

Fig. 6.2.1: Question 2 response.

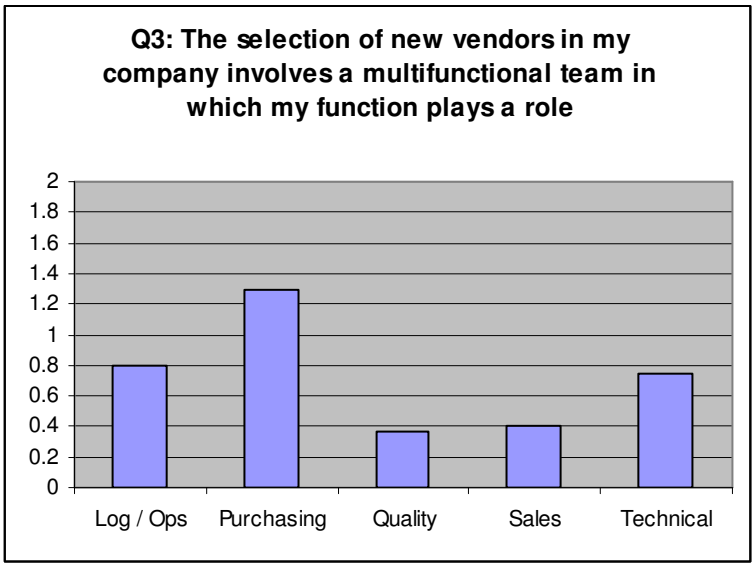
While there logistics group are more confident that such a process is in place, purchasing and quality only agree. There are notably larger deviations in technical, purchasing and quality groups. This seems to be reflected in how they perceive their interests being represented in the process. Comments below are typical of all contributors all 3 below work in a regulated industry. #67 argues that the process always leans to cost while #51 would argue the opposite. #15 is in a logistics role comments that often there is not time to rigorously follow the process.

"*There is a very detailed procedure to assess risk of choosing vendor, it relies more on the financial side than on the technical capability of the vendor*" (#67)

"*Quality Dpt. seems to have a quite formal process in place while there is nothing existing in Finance or Procurement*." (#51)

"*We do have processes however I would not say that they are followed 100% of the time"* (#15)

Q3: “The selection of new vendors in my company involves a multifunctional team in which my function plays a role”



Q3	Log / Ops	Purchasing	Quality	Sales	Technical
mean	0.8	1.29	0.36	0.4	0.74
sd	1.14	0.83	1.03	0.89	1.1

Fig. 6.2.2: Question 3 response.

As expected purchasing agree that they are involved in a multifunctional team but only just. While logistics and technical somewhat agree sales and quality score poorly. Response to this question shows a high degree of deviation. The reason for this is unclear. Interpretation of comments indicate that involvement of some stakeholders may be minimal, more of a formality than a real role in the decision making process. Typical comments may be seen below

“The process allows for input from various functions; however the central purchasing group award contracts primarily based on price…although production capacity and material lead-time are also strong factors in the decision” (#19)

“We try to always involve the right people in making sourcing decisions but there are certainly times when this does not happen. (#15)

It depends on the reason why we select new vendors (innovation, cost saving, supplier optimization…)” (#51)

Q4: "Suppliers are key business partners and as such great effort should be invested into their selection"

Q4	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1.6	1.57	1.18	1.4	1.79
sd	0.97	0.51	1.25	0.55	0.42

Fig. 6.2.3: Question 4 response.

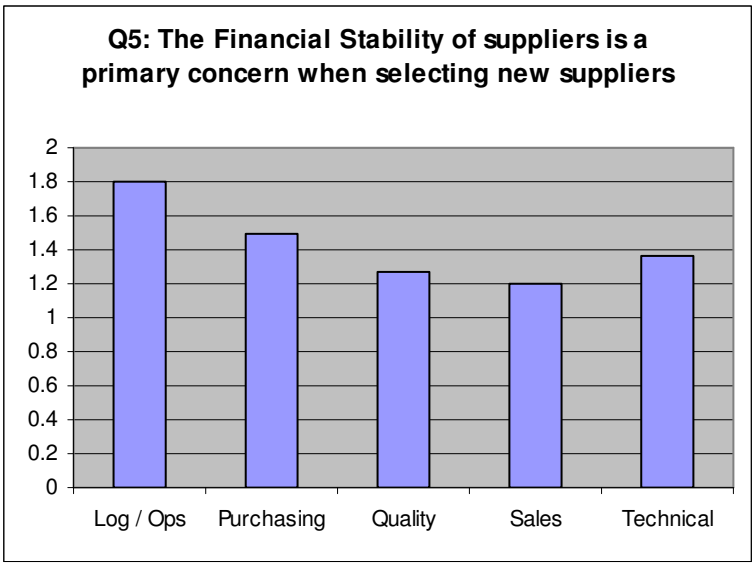
All functions appear to more than agree with this statement. In this case it is difficult to determine if this is rhetoric or reality. Logistics work most closely with suppliers on a daily basis, purchasing depends on them for their lively hood. The high deviation that exists in the quality function may relate to the often confrontational nature of the relationship between QA and their suppliers.

"I think that as about 90-95% of the material used in our product is sourced externally supplier is definitely key business partner and should be worked with very closely" (#67)

"I agree that time should be invested in the right relationships. Only if suppliers are going to provide a long term competitive advantage is it worth spending a great deal of time. If business is a one shot standard commodity then selection should be minimal providing the quality is OK." (#36)

"As you change your strategy you need to ensure your supplier is aware and have capability to react without impacting service/ quality & cost. - Ability/ capacity to move to JIT etc. The Supplier is always a good place to start looking for cost saving / design improvement etc." (# 16)

Q5: "The Financial stability of suppliers is a primary concern when selecting new suppliers"



Q5	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1.8	1.5	1.27	1.2	1.37
sd	0.42	0.52	0.79	0.45	0.6

Fig. 6.2.4: Question 5 response.

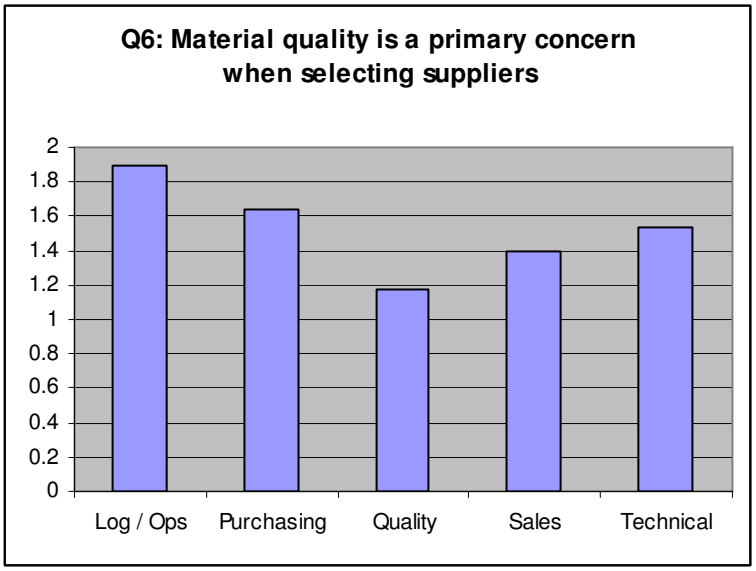
This question scored remarkably highly. While logistics and purchasing would be most expected to be aware of the suppliers financial position one would not expect this to be of concern to other functions. It appears that the economic down turn may have increased awareness of financial risk. In single sourcing, supplier closures can hit continuity of supply. This can be seen in the comments below.

"Unfortunately, it was sometimes the last item checked on the list. However, this is changing since the recent economic slow-down" (#51)

"I don't think this would have been considered as much a year ago but this year it is always a question that is asked". (#15)

"As our product relies heavily on supplier it is vital that the financial stability of supplier is one of the critical parameter assessed when selecting a supplier. If this is not done correctly it could have a impact heavily a product as it is difficult to change supplier when a product is commercialised. Risk management typically tries to alleviate this by having multiple suppliers validated on critical component if possible". (#67)

Q6: "Material quality is a primary concern when selecting new suppliers"



Q6	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1.9	1.64	1.18	1.4	1.53
sd	0.32	0.5	0.87	0.55	0.77

Fig. 6.2.5: Question 6 response.

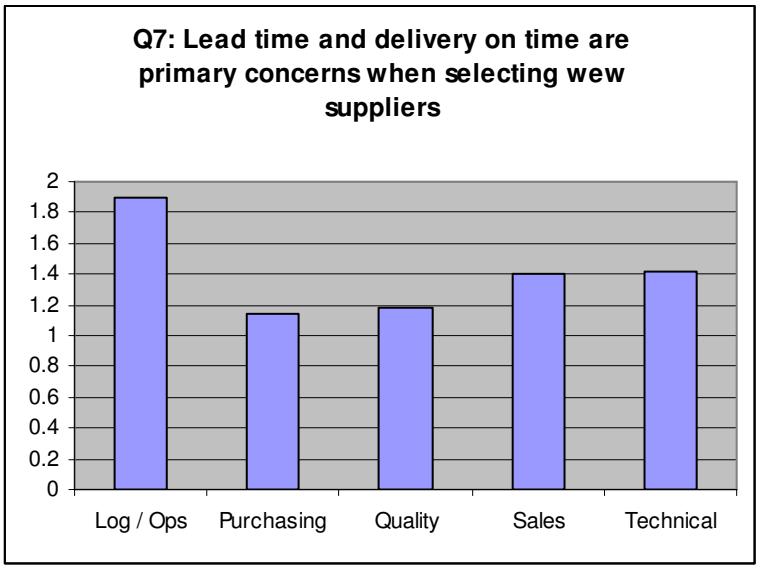
While this scores quite highly the QA function scores it lowest. Comments below appear to focus on verifying the capability to supply quality material and services after selection.

"Feedback is sought from the QA group, and a supplier that does not meet basic QA requirements would not be selected. A history of previous quality issues will be noted and used in the negotiations of the contract, but may not be the make-or-break decision factor". (#19)

"Quality is part of the best total value selection and is one of a key allocation factor. However, supplier quality capabilities are only verified when the supplier produces the first material. Selection is checking capabilities via supplier QA assessment but real capabilities are usually confirmed during the qualification process. Selection criteria 1.price, 2. supplier capabilities (QA/logistic) 3. lead time. Financial health is a go or no-go in the allocation/recommendation" (#29)

"You need to have confidence that the supplier deliver product that will arrive on time and in good quality (to specification) so it will run on the production line reliably and will look good on shelf"(#16)

Q7: "Lead time and delivery on time is a primary concern when selecting new suppliers"



Q7	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1.9	1.14	1.18	1.4	1.42
sd	0.32	0.53	0.6	0.55	0.69

Fig. 6.2.6: Question 7 response.

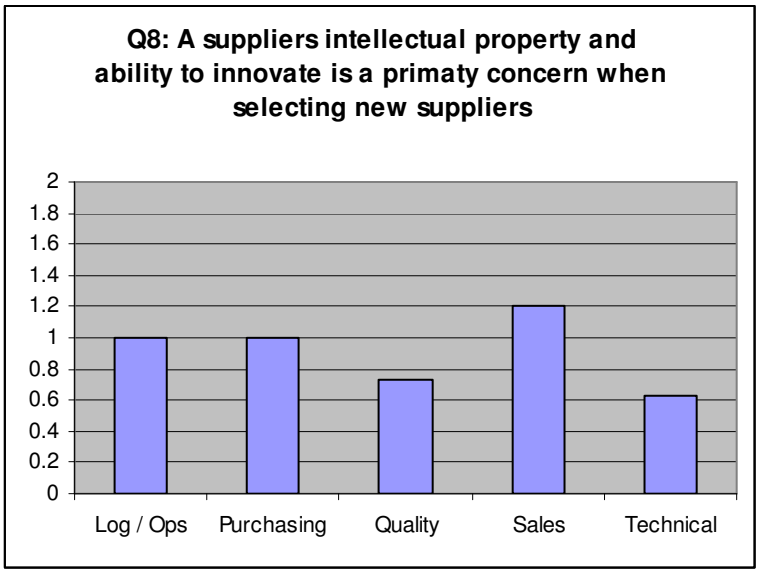
As expected while all functions recognise the importance of lead time and delivery the logistics and operations functions are most exposed to the risk of delayed or long delivery times. The general agreement with this may also reflect the widespread adaptation of JIT. The 2 comments below are from purchasing professionals who have begun to understand the cost of short lead times and see potential compromises that may be made through sourcing from low cost countries. The last comment recognises the need for flexibility.

"This is essential to ensure smooth running of the business however this needs to be at the right cost. It is possible to over-engineer product specs and quality requirements which incurs additional cost at suppliers and delivers little or no benefit to the consumer" (#36)

"Delivery on time is a must. However, we sometimes choose to source from low cost countries (like China) which increase the order to delivery lead-time. But this is manageable as long as you can anticipate. (#51)

"Flexibility to meet unexpected demand is key; also ability to react to new initiatives with short supply chain is key business advantage "(#16)

Q8: "A suppliers intellectual property and ability to innovate is a primary concern when selecting new suppliers"



Q8	Log / Ops	Purchasing	Quality	Sales	Technical
mean	1	1	0.73	1.2	0.63
sd	1.05	0.55	1.19	0.45	0.9

Fig. 6.2.7: Question 8 response.

Innovation appears to score lowest of the four priorities for new vendor selection. Sales rates this the highest will little deviation. Could it be that Sales see the innovative ideas coming from suppliers rather than within the firm? In general the comments reflect on innovative partnerships as being more aspiration than the reality.

"This is a definite benefit; however our company has the R&D resources to some of the development work on new materials, hence is not solely reliant on the supplier for this" (#19)

"Intellectual property is a contentious issue with many suppliers slow to develop it in partnership with customers. In any NPD programme it is often difficult to get a supplier to consider opportunities which are outside their remit, regardless of the future potential (not solution focussed)" (#46)

"This varies depending on the situation. With some suppliers we just want them to provide good quality packages to designs that we have specified. In other areas we want the suppliers themselves to be innovative and to bring ideas to us" (#15)

6.3 Review of Questionnaire 2 Data

Of the 59 individuals that responded to the survey 6 failed to complete the second section. These results represent a population of 53 contributors and only 12 of the contributors added comments. The differences of opinions are very evident through typical standard deviations ranging from 3.42 to 2.66. The mean score per vendor measure and standard deviation may be seen in Fig 6.3.1.

Measure	Mean Score	sd
1. Cover for creditors (Ratio)	5.31	**3.28**
2. % Material unit cost	8.94	**3.42**
3. Days credit	4.71	**2.91**
4. % Customer Complaints	8.52	**2.91**
5. % Complaint Responses	7.15	**2.79**
6. % Repeat Complaints	7.15	**2.99**
7. % Deliveries on time	8.65	**2.66**
8. Lead Time	7.67	**2.54**
9. % Min. Order Quantity	6.15	**2.73**
10.% Investment in R&D	5.73	**2.94**
11. % Sales from New Products	4.58	**3.8**
12. % Value of IP	3.42	**3.08**

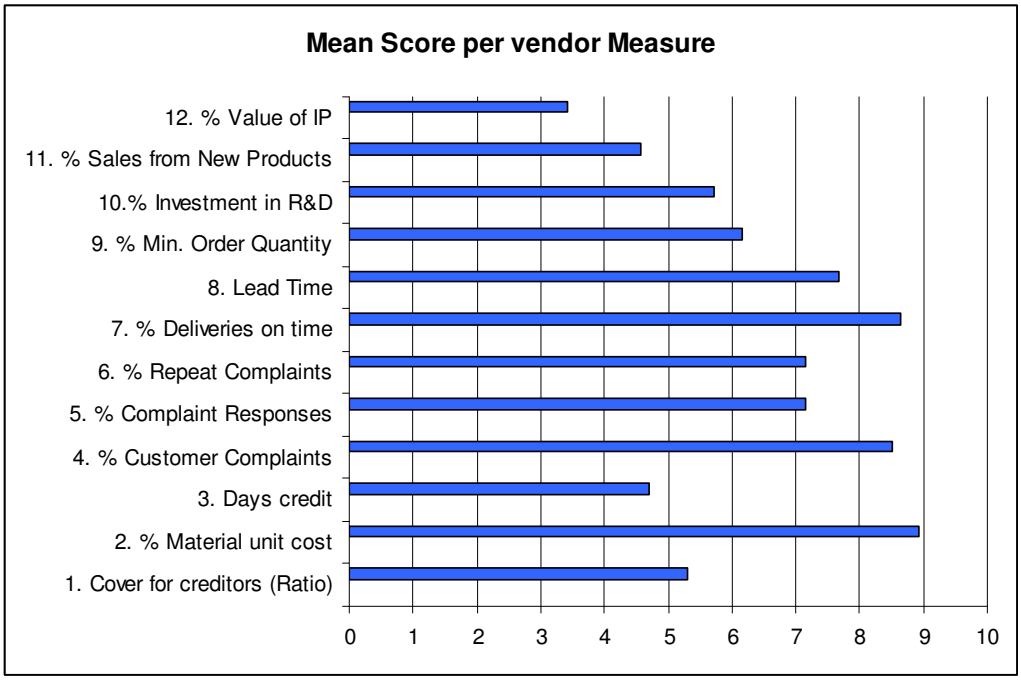


Fig. 6.3.1: Mean Score and Standard Deviation per measure.

In order of preference the key measures may be listed as follows..

Measure	Mean Score	sd
2. % Material unit cost	8.94	**3.42**
7. % Deliveries on time	8.65	**2.66**
4. % Customer Complaints	8.52	**2.91**
8. Lead Time	7.67	**2.54**
5. % Complaint Responses	7.15	**2.79**
6. % Repeat Complaints	7.15	**2.99**
9. % Min. Order Quantity	6.15	**2.73**
10.% Investment in R&D	5.73	**2.94**
1. Cover for creditors (Ratio)	5.31	**3.28**
3. Days credit	4.71	**2.91**
11. % Sales from New Products	4.58	**3.8**
12. % Value of IP	3.42	**3.08**

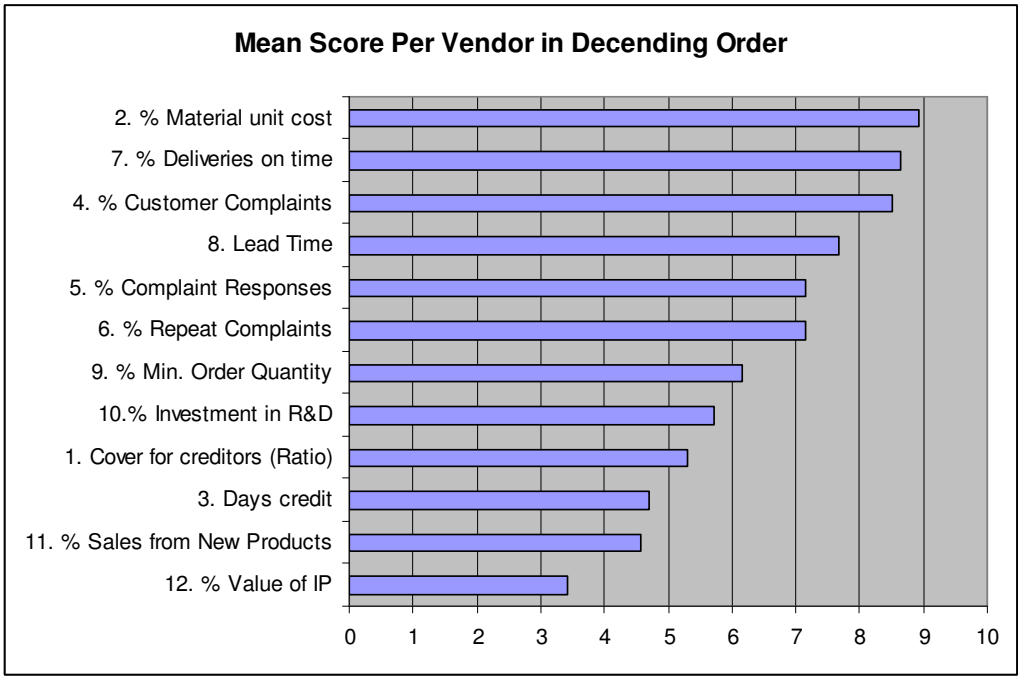


Fig. 6.3.2: Mean Score per measure in descending order.

From the above there is clear agreement that price ranks as the most important measure for selecting a new vendor. This is closely followed by on-time delivery and quality. Lead time also appears as a priority, this is possibly due to the heightened awareness of JIT throughout most manufacturing companies. The quality responsiveness measures of complaint responses and repeat complaints rank 5th and 6th respectively. This is followed by minimum order quantity and investment in R&D. This is the only instance of an innovation measure ranking in the top 10 measures.

Considering the high score for financial stability expressed in survey 1, cover for creditors ranks poorly in 9th place. This may be due to a poor understanding of the measure. The number of days credit measure ranks 10th. Other innovativeness measures such as sales from new products and value of IP rank 11th and 12th. This ties-in well with the feedback from survey 1 where innovation rated poorly. This may also relate to a poor understanding of innovation and intellectual property as indicated by contributor 74 a chemist in the Pharmaceutical business.

"What does IP mean? -Internal Presence? Internal profit? " (#74)

All contributors were invited evaluate the usefulness of these measures on a scale of 1 -10. They scored as follows

	Average	Maximum	Minimum	Std. dev.
Score	7.3	10	2	1.57

These results reflect a low level of consensus among the contributors. Contributors were invited to comment on the usefulness but very few did. The few comments that were offered included ..

"Ranking of these measures varies greatly with industry, brand and overall business strategy" (#31)

"I think that these measures are important but I think that they would have to be used in parallel with other information in order to be useful. The supplier as a whole needs to be looked at and the importance of the measures vary from situation to situation." (#15)

Contributors appear to be in agreement that the priorities will vary due to the business type and the current business strategy. As some technologies mature the strategy may be to focus ore on cost than innovation to maintain a competitive advantage.

"For my Logistics role in a manufacturing Plant, the most important supplier criteria for us is Cost, Cash (Inventory, MOQs) and Time (Target lead-time < 7 days, using hubbing for non EU suppliers)" (#24)

"Mainly concerned with ability to deliver order on-time and at the right price, security of access to the material usually important, financials secondary concern" (#78)

The above comments reflect the top 3 ranking measures ie. right price, right place/time at the right quality.

"Need to ensure that Supplier really understand your business complexity and that the service they are offer is priced based on how you run your business and that you benchmark correctly vs a current supplier" (#16)

Contributor 16 has highlighted the importance of sharing the correct information and being very clear of their expectations of the supplier when tendering business.

6.4 Summary

This chapter has tabulated and reviewed the data from the 2 surveys carried out. High standard deviations suggest that the surveys have demonstrated very poor level consensus throughout the population of 58 contributors.

Survey 1 indicates that while all functions agree on the importance of selecting the best suppliers, there is some dissatisfaction in the process used to select new vendors or in their involvement in the process. Financial stability of suppliers is a concern for all functional groups, a fact that may relate to recent closures due to the economic down turn. Logistics and quality are also of importance to all groups while intellectual property scores lowest in priority.

Survey 2 indicates that of the 12 measures proposed that price, on-time delivery, quality and lead time are the most important measures when seeking new suppliers. The overall value of these measures was rated as 7.3 out of 10. Comments have indicated that priorities will vary depending on the business and current business strategy.

Chapter 7 will discuss these results in the context of the rest of this text.

Chapter 7: Discussion, Conclusions and Recommendations

7.1 Limitations of the research

Before discussing the results of the research it is prudent to recognise the limitations of this work.

As indicated in chapter 5 this is a cross sectional study which has surveyed one aspect of business during the summer of 2009. This is effectively a snap-shot of a time, when phrases such as “economic downturn” and “recession” are on everybody’s lips and factory closures have become common place. If this research was carried out on the same group in the summer of 2007 the outcome may be different.

The survey population in this research is quite small with 59 of a possible 78 individuals responding. Dickson surveyed 273 purchasing managers in his 1966 survey, 170 responded. This research is not exclusive to purchasing managers as involvement in vendor selection has opened-out to many other manufacturing functions. This is a significant change since Dickson’s 1966 work.

Due to accessibility the business sectors involved in the research have primarily been those of FMCG (fast moving consumer goods), Packaging, Medical Device and Pharmaceutical. Many of these business sectors are highly regulated with documented guidelines for vendor selection. This represents a small segment of manufacturing, leaving large sectors such as automotive, ICT and electronics unrepresented. It is not unreasonable to suspect that these segments may have differing vendor selection priorities.

This research has not considered the suppliers of services an area that may also differ significantly form that of manufacturing. Contracted scope of service and quality of service would most likely feature most highly as a concern while minimum order quantity may not exist.

7.2 Discussion

Table 7.2.1 illustrates a comparison of the top 6 ranking criteria identified in the research carried out by Dickson, Weber et al. and this thesis.

Dickson 1966	Weber et al. 1991	Costello 2009
1. Quality	1. Net Price	1. Cost
2. Delivery	2. Delivery	2. On-time deliveries
3. Performance History	3. Quality	3. Quality (complaints)
4. Warranty & Claims	4. Facilities & Capacity	4. Lead time
5. Facilities & Capacity	5. Geographic location	5. Complaint Responses
6. Net Price	6. Technical Capability	6. Repeat Complaints

Table 7.2.1 Comparison of top 6 criteria

The changes and developments between the 1966 and the 1991 publications have been discussed in chapter 2. The similarities between the 1991 and 2009 surveys are remarkable. Although the Weber et al research was literature based the first 3 criteria are identical. As the language in manufacturing has changed over the years "lead time" may have been describes as "geographical location" in Dickson's time. For Dickson location ranked 20th for Weber et al. 5th, if we can interpret this as lead time, it ranks 4th in this survey. It would not be unreasonable to assume that the increased concern of location has primarily been driven by JIT to reduce inventory and the lean enterprise that must be responsive to the customers' demands. As manufacturing has become globalised and many suppliers use complex logistic processes such as hubbing, geographical location is of less concern than the actual lead time from order to delivery. The overall consensus in this research appears to validate the cliché

"Right product (quality) in the right place (delivery) at the right price"

The results of survey 1 have indicated a lack of consensus regarding the effectiveness of vendor selection procedures and the involvement of various functional groups. While many agree on the importance of selecting the best suppliers, few agree that in their experience that the processes in place are effective. The comments in section 6.2 reflect a high level of dissatisfaction with these processes. In many cases it appears that while various functions may appear to be involved in the process, in most cases the purchasing function will make the final decision irrespective of the other inputs. It is the experience of the author that in many firms where an empirical selection process is in place to identify the apparent best supplier, the purchasing manager may veto this appointing another supplier for unidentified strategic reasons. In the case of large firms with several different business units and centralised purchasing this may be a supported by valid reason but it can be very frustrating for those in the individual business unit involved. It is understandable to expect reduced participation from other functional groups during subsequent new vendor enquiries if they feel their input has made little difference in the previous one.

The feedback from survey 1 forces the question **"Does the reality reflect the rhetoric"**. All agree on the importance of the supplier, even indicate that there are processes in place but express a high level of dissatisfaction with them. The current processes summary in chapter 3 would support this. Many organisations need a formal vendor selection system to meet regulatory compliance. It appears that in many cases much of the selection criteria has been a cut and paste with requirements taken from ISO, FDA and other regulatory publications. While meeting the regulatory commitments these processes are often not value adding. The process meets the letter but not the spirit of the guidelines. Very few processes have any metrics that may be used in the making of clear and transparent vendor selection decisions.

Many of the vendor selection processes identified in chapter 3 have failed to identify what is most important to them. The priorities will vary from business to business and quite often depending on the commodity that is being purchased. The use of a generic selection tool may add very little value to the process. One (selection) tool may not fit all jobs.

As the business environment changes so too may a firms needs from their suppliers. Swings in demand may require greater responsiveness from the supplier while during a phase of technology change innovation may be a key requirement from suppliers. In times of rapid economic and technological growth the key to success has been first to market requiring speed and innovation with little concern for cost. As technologies mature and markets face an economic downturn similar to current strategies must change and the lowest price will win.

While one set of vendor selection criteria may not fit all business at all times there is perhaps an opportunity for a generic vendor selection process. The process should identify all of the correct functions to be involved and agree the most relevant selection criteria. While criteria proposed in chapter 4 may be a useful starting point in many cases these criteria will very per commodity. It is important that these criteria be weighted and must have some form of empirical metric. In addition to these metrics there will always be some specific “must have” criteria, some may be regulatory requirements while others may relate to quality, logistics or communications requirements as simple as the language they speak.

The whole vendor selection process can be very involved and resource intensive when carried out diligently. This is probably why many are dissatisfied with the process in their organisation. This process may be considered excessive when sourcing your office stationary but may be essential when deciding on where to allocate your $10million annual spend on printed packaging. It would be reasonable to consider a spent threshold above which the vendor selection process should apply. The application of a formal selection process carried out properly on fewer suppliers would add more value than a process that is not carried out fully on all suppliers.

Having discussed formal processes and metrics it must be recognised that for many firms there are intangible elements. Some believe that first impressions from the first meeting is enough to know if this is the type of supplier you want to work with while others describe it as cultural fit. It is always an element that will always exist in selecting new suppliers.

7.3 Conclusions

From the results in chapter 6 and discussion in section 7.2 we can make the following conclusions.

The concept of cost, quality and on-time delivery are as relevant to purchasing managers in the selection of new suppliers today as it was for Dickson in 1966 and for Weber et al. in 1991. This has been supported by the results of Survey 2. The survey has also demonstrated that there is little formal understanding or emphasis on the ability of the supplier to innovate. Firms that value IP and innovation are often very reluctant to share information with suppliers.

From the review of current procedures used and the results from survey 1 it is apparent that the vendor selection processes employed in many organisations are ineffective and not value adding. Where selection criteria have been documented, in many cases they have not been Key Performance Indicators and do not contain true metrics. In many cases the selection process is generic and has become a cut and paste exercise taking procedures from processes documented by some other company or organisation. Where selection criteria have been applied they are often not specific to the needs of the organisation or the item being procured. In the view of some survey respondents their processes are a “paper exercise” and lack transparency.

While purchasing professionals may be highly trained in their role they cannot have a full in depth understanding of all of the needs of all stakeholders within the organisation. Specific details regarding logistics, specific quality requirements or technical constraints are best communicated by the people directly involved and must be clearly defined before inviting tenders from new suppliers. This can avoid many supply issues later in the relationship. There is a need for cross functional co-operation in the identification to the most relevant vendor selection criteria for all significant sourcing studies. The selection process and criteria must fit with the current strategy of the organisation.

The process of new vendor selection can by very involved and resource intensive. To gain the optimal value, this process may be best applied when selecting the most important suppliers, perhaps based on the value of annual spend or the technology being procured.

7.4 Recommendations for Further Research

As indicated at the beginning of this chapter, this research has been cross-sectional carried out over a few months in the summer of 2009. A longitudinal study would offer more valuable data when trying to determine the best key performance indicators when selecting new suppliers. A good approach would be to evaluate some new suppliers according to a proposed set of metrics and monitor their progress over a series of years. The supplier's performance could be monitored using the vendor scorecard used in most organisations. This study would identify the best performing suppliers and isolate the selection criteria they scored highest on. This work would be very difficulty to do retrospectively as the evaluation must take place at the beginning of the relationship with the customer. Where effective supplier continuous development programmes are in place it is reasonable to expect the vendor to achieve a higher score on the vendor selection scale after some time supplying the customer.

Survey 2 has focussed on ranking the 12 proposed selection criteria in order of importance. Further work could be carried out to determine a weighting factor for each key performance indicator to give a more accurate evaluation of a supplier.

This thesis has focused on manufacturing companies and the materials and components they purchase. A similar study on suppliers of services may be of value to other business sectors.

Bibliography

Baily P., Farmer D., Jessop D., Jones D. (1998) "Purchasing Principles & Management" Eighth Ed., Financial Times Management, London

Barla, S.B. (2003): “A case study of supplier selection for a lean supply by using a mathematical model”, *Logistics and Information Management*, Vol.16, No.6, 2003, pp451-459.

Barney, J. (1991): “Firm Resources and Sustained Competitive Advantage”, *Journal of Management*, Vol.17, No.1, 1991, pp99-120.

Braglia M., Petroni A., (2000) "A quality assurance-oriented methodology for handling trade-offs in supplier selection" *International Journal of Physical Distribution & Logistics Management*, Vol. 30, No.2, 2000, pp96-111.

Childe S J (1998): “The extended enterprise - a concept of co-operation”, *Production Planning & Control*, Vol 9, No 4, pp320-327.

Christopher M (2000): “The Agile Supply Chain”, *Industrial Marketing Management*, No 29, pp37-44.

Goffin K, Szwejczewski M., New C. (1997): "Managing suppliers: when fewer can mean more", *International Journal of Physical Distribution & Logistics Management*, Vol.27, No.7, 1997, pp 422-436.

Haq A.N., Kannan G., (2006): An integrated approach for selecting a vendor using grey rational analysis", *International Journal of Information Technology & Decision Making* Vol.5, No.2, 2006, pp277-295.

Hemaida R., Schmits J. (2006): “An Analytical Approach to Vendor Selection", *Industrial Management*, May-June 2006, pp18-24.

ICH / Q9. (2005) "Quality Risk Management" 'www.fda.gov,OHRMS/DOCKETS/98fr/FDA-2008-N-0356-bkg-02-08-2008.pdf (Retrieved June 28th 2009)

ISO / TC176. (2000) "Quality Management Systems - Requirements" (ISO: 9001.2000), International Standards Organisation, Geneva

ISO / TC210. (2003) "Medical Devices- Quality Management Systems - Requirements for Regulatory Purposes" (ISO: 13485.2003), International Standards Organisation, Geneva

Jagdev H.S., Browne J., (1998): "The Extended Enterprise - a context for manufacturing" *Production Planning and Control*, Vol.9 No.3 P216-219.

Juran, Gryna (1982) "Quality Planning and Analysis", 2nd ed., New Delhi, McGraw -Hill Publishing Company Limited, p227.

Mac Duffle, J.P., Helper, S. (1997): "Creating Lean Suppliers" *California Management Review*, Vol. 39. No. 4, Summer 1997.

Manzer L.L., Ireland R.D., Van Auken P.M. (1980): “A Matrix Approach to Vendor Selection for Small Business Buyers", *American Journal of Small Business*, Vol. IV, No. 3, Winter (Jan - Mar) 1980, pp21-28.

Masella, C., Rangone, A. (2000): "A Contingent Approach to the design of vendor selection systems for different types of co-operative customer/supplier relationships", *International Journal of Operations & Production Management*, Vol. 20, No.1, 2000, pp70-84.

Mills & Robertson (1999) “Fundamentals of Managerial Accounting and Finance",4th ed., Glouster;Mars Business Associates.

Morgan, J. (2001): "New Survey finds big gap between rhetoric and reality", *Purchasing*, Nov. 15th 2001, pp10-11.

Nelson, R.D. (2004): "How Delphi Went Lean", *Supply Chain Management Review*, Nov.-Dec., 2004, pp33-37.

Nydick, R.L., Hill R.P. (1992): “Using the analytic Hierarchy Process to Structure the Supplier Selection Procedure", *International Journal of Purchasing and Materials Management*, Spring 1992, pp31-36.

Porter M. E. (1979): "How Competitive Forces Shape Strategy", *Harvard Business Review*, March - April 1979, pp137-145.

Prahalad C.K., Hamel G. (1990): “The Core Competence of the Corporation", *Harvard Business Review*, May-June 1990, pp79-91.

Saunders, M., Lewis.P. and Thornhill,A. (2007) "Research Methods for Business Students", Fourth Ed,,Financial Times / Prentice Hall, Harlow England New York

Seydel J. (2005): "Supporting the Paradigm Shift in Vendor Selection: Multi-criteria Methods for Sole Sourcing" *Managerial Finance*, Vol.31 No.3 2005 pp49-66.

Stalk G. (1988): "Time-The Next Source of Competitive Advantage", *Harvard Business Review*, July-August 1988 pp 41-51.

Stalk G., Evans P., Shulman L.E. (1992): "Competing on Capabilities: The New Rules of Corporate Strategy" *Harvard Business Review*, March-April 1992.

Vonderembse M.A., Tracey M. (1999): "The Impact of Supplier Selection Criteria and Supplier Involvement on Manufacturing Performance", *The Journal of Supply Chain Management*, Summer 1999, pp33-39.

Weber C A., Current J.R., Benton W.C. (1991): "Vendor Selection Criteria and Methods", *European Journal of Operational research*, No. 50 1991, pp2-18.

Womack J.P., Jones D.T. (1994): "From Lean Production to the Lean Enterprise", *Harvard Business Review*, March-April 1994, pp93-103.

Appendix A

Survey Questionnaires

VENDOR SELECTION QUESTIONNAIRE

Please note that this questionnaire is a reflection of your professional opinion rather than your companies policy
All replies are handled with complete confidentiality
Please answer all **8 questions** on this sheet and complete the **score card** on the next sheet
Please place "X" in the box most appropriate to your opinion of the following statements.

1 Which of the following functions best describes your role in your company.

☐ Purchasing ☐ Sales/Customer service ☐ Logistics/Operations ☐ Technical ☐ Quality Assurance

2 *"The company I work for has a detailed documented formal process for the selection of new vendors"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

3 *"The selection of new vendors in my company involves a multifunctional team in which my function plays a role"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

4 *"Suppliers are key business partners and as such great effort should be invested into their selection"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

5 *"The Financial stability of suppliers is a primary concern when selecting new suppliers"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

6 *"Material quality is a primary concern when selecting new suppliers"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

7 *"Lead time and delivery on time is a primary concern when selecting new suppliers"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

8 *"A suppliers intelectual property and ability to innovate is a primary concern when selecting new suppliers"*. Would you ..

☐ Strongly agree ☐ Agree ☐ neither agree nor disagree ☐ Disagree ☐ Strongly disagree with this statement.

Additional Comments:

SCORE CARD

Description	Measure	Score
1. Cover for creditors (Ratio)	Current Assets-Stock-Bank Overdraft/ Trade Creditors	
2. % Material unit cost	Unit Cost / Benchmark cost x 100	
3. Days credit	Number of days credit from delivery of goods	
4. % Customer Complaints	No. complaints / No. deliveries per year x 100	
5. % Complaint Responses	No. complaints addressed on time / Total No. Complaints x 100	
6. % Repeat Complaints	No. repeat complaints / Total No. Complaints x 100	
7. % Deliveries on time	Number of on time deliveries / Total number of deliveries x100	
8. Lead Time	Number of days from placement of order to delivery	
9. % Min. Order Quantity	Minimum Order Quantity / Annual Forecast Volume x100	
10.% Investment in R&D	Annual Investment in R&D / Annual Gross Profit x100	
11. % Sales from New Products	Annual Sales from new products / Total Annual Sales x100	
12. % Value of IP	Value of IP (Market value - Book value of company) / Book value x100	

How would you evaluate the usefulness of these measures ? Please score from 1 - 10 (10 being most useful)	
Additional Comments:	

Please evaluate the following supplier measures and award scores from 12points to 1 point in order of what you consider most important.
Award 12 points for the most importand measure to 1 point for what you consider to be the least important measure.
It's the same principle as scoring in the Eurovision song contest.
Please note that this questionnaire is a reflection of your professional opinon rather than your companies policy.

Thank you for sharing your valued and expert opinion.
Michael Costello

Appendix B

Survey Group

#	Business	Who	Role	Comments
1	Pachaging	Joe Holland	S/CS	
2	Pachaging	AM Hession	S/CS	
3	Pachaging	TJ Carr	QA	
4	Pachaging	Sinead O Connor	S/CS	
5	Pachaging	D Cronin	S/CS	
6	Pachaging	M Krapp	S/CS	
7	Pachaging	J Bingle	S/CS	
8	Pachaging	J Nowoka	S/CS	
9	Pachaging	M Seyda	S/CS	
10	Pachaging	U Schmeiderer	S/CS	
11	Pachaging	R Schuschmann	S/CS	
12	Pachaging	T Schilling	S/CS	
13	Pachaging	J Narasse	S/CS	
14	FMCG	M O Brien	log/ops	
15	FMCG	J Morrisey	log/ops	
16	FMCG	J OConnell	log/ops	
17	FMCG	M Lenehan	log/ops	
18	FMCG	S. Treacy	log/ops	
19	FMCG	E Dalton	QA	
20	FMCG	M Seymour	QA	
21	FMCG	Mgt O Brien	QA	
22	FMCG	W Meagher	QA	
23	FMCG	J McCarthy	QA	
24	FMCG	P Hennessy	log/ops	
25	FMCG	G Rey	log/ops	
26	FMCG	G Dillon	log/ops	
27	FMCG	M Sexton	log/ops	
28	FMCG	F Dauxere	Purchasing	
29	FMCG	C Aldinger	Purchasing	
30	FMCG	V Lenz	Purchasing	
31	FMCG	W Hotzel	Purchasing	
32	FMCG	J Vanderbranden	Purchasing	
33	FMCG	B Guiteau	Purchasing	
34	FMCG	B Adams	Purchasing	
35	FMCG	J Belabidi	Purchasing	
36	FMCG	M Pascoe	Purchasing	
37	FMCG	M Chaney	Purchasing	
38	FMCG	B Orszag	Purchasing	
39	FMCG	L Meade	Technical	
40	FMCG	S Evans	Technical	
41	FMCG	N Graves	Technical	
42	FMCG	T Dandy	Technical	
43	FMCG	G Mitchell	Technical	
44	Other	R Corker	Technical	
45	Other	D Talon	Technical	
46	Med/Pharma	D Ronan	Technical	miss part 2
47	Med/Pharma	G Kelly	Technical	
48	Other	C McManus	log/ops	
49	Other	F Kirrane	Technical	
50	Med/Pharma	J Treacy	log/ops	
51	FMCG	K Botti	Purchasing	
52	Med/Pharma	A Costello	QA	
53	Med/Pharma	D Costello	QA	
54	Pachaging	R Lucoscva	QA	
55	Pachaging	P Regan	QA	
56	Pachaging	P Dienko	QA	
57	Other	P Goff	QA	
58	FMCG	C Anger	log/ops	
59	Other	J Gantillon	QA	miss part 2
60	Packaging	D Mantle	Technical	
61	FMCG	V Mckenna	Technical	
62	FMCG	T Parr	Purchasing	
63	P&G	T Fahy	Purchasing	
64	Other	Aisling Higgins	Purchasing	
65	Other	Jarlath Folan	Purchasing	
66	Packaging	Geraldine Holland	Purchasing	
67	Med/Pharma	Aram	Technical	
68	Med/Pharma	David	Technical	
69	Other	A Urs	Purchasing	
70	FMCG	S. Ryan	Purchasing	
T1	FMCG	M Hughes	Purchasing	miss part 2
72	FMCG	A Hesse	Purchasing	
73	Med/Pharma	C Connoley	Technical	miss part 2
74	Med/Pharma	M Larkin	QA	
75	FMCG	C Mathers	QA	miss part 2
76	FMCG	L Egan	log/ops	
77	Med/Pharma	C Anisboro	Technical	
78	Med/Pharma	E Donnelly	QA	

Appendix C

Response to Survey 1

	Role	#	Role	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Comments
1	s	2	s	1	1	2	1	2	2	1	n
2	t	3	t	1	0	2	1	2	2	1	n
3	l	4	l	2	2	2	2	2	2	2	n
4	s	5	s	0	-1	2	2	1	1	1	n
5	s	6	s	1	0	1	1	2	2	1	n
6	s	9	s	0	1	1	1	1	1	1	n
7	l	14	l	2	1	2	2	2	2	2	y
8	l	15	l	1	1	2	2	2	2	1	y
9	s	16	s	1	1	1	1	1	1	2	y
10	l	17	l	1	-1	2	1	2	2	0	y
11	t	18	t	1	1	2	2	1	2	1	y
12	q	19	q	1	1	1	1	0	1	0	y
13	q	20	q	1	0	2	2	2	1	1	n
14	q	21	q	2	2	2	2	2	1	1	n
15	q	22	q	1	0	1	1	1	1	1	n
16	q	23	q	2	0	2	1	0	1	0	y
17	l	24	l	1	1	2	2	2	2	1	y
18	l	25	l	2	0	2	2	2	1	0	y
19	l	27	l	2	-1	2	2	2	2	2	y
20	p	29	p	0	2	2	2	1	1	0	y
21	p	30	p	-1	1	1	2	1	1	0	n
22	p	31	p	2	2	2	2	2	1	2	y
23	p	36	p	1	2	1	2	2	1	1	y
24	p	37	p	1	2	1	2	2	2	1	y
25	t	39	t	1	2	2	2	2	2	1	n
26	t	40	t	1	-1	2	1	1	0	-1	n
27	t	41	t	2	2	2	2	2	2	1	n
28	t	42	t	1	0	1	1	0	0	1	n
29	t	44	t	1	1	2	2	2	2	2	n
30	t	45	t	-2	1	2	1	2	2	1	n
31	t	46	t	2	0	2	2	2	1	2	y
32	t	47	t	0	0	1	2	2	2	1	n
33	t	48	t	-2	1	2	1	2	2	1	y
34	t	49	t	-1	1	2	1	2	1	1	n
35	l	50	l	2	2	-1	2	2	2	-1	n
36	p	51	p	0	1	2	1	2	1	1	y
37	q	52	q	1	1	1	0	1	1	0	y
38	t	53	t	-1	-2	1	1	2	1	0	n
39	q	57	q	-1	1	2	2	1	2	2	n
40	l	58	l	1	1	1	1	1	2	1	n
41	q	59	q	1	-2	-2	1	0	0	-2	y
42	t	60	t	2	2	2	2	2	2	1	y
43	t	61	t	2	2	2	2	2	2	1	n
44	p	62	p	1	1	2	1	2	1	1	y
45	p	64	p	1	1	1	1	1	1	1	y
46	p	65	p	2	2	2	2	2	0	1	y
47	p	66	p	2	1	2	1	1	1	1	n
48	t	67	t	1	2	1	1	1	1	0	y
49	t	68	t	-1	0	2	1	0	1	0	y
50	p	69	p	2	1	2	1	1	1	1	n
51	p	70	p	2	2	1	1	2	1	1	n
52	p	71	p	1	1	2	2	2	2	2	y
53	p	72	p	2	-1	1	1	2	2	1	n
54	t	73	t	2	1	2	1	0	1	-1	n
55	q	74	q	2	0	2	2	2	2	1	n
56	q	75	q	1	1	2	2	2	2	2	n
57	l	76	l	2	2	2	2	2	2	2	n
58	t	77	t	2	1	2	0	2	1	-1	y
59	q	78	q	1	0	0	0	2	1	2	y

Appendix D

Response to Survey 2

	#	Role	KPI 1	KPI1 2	KPI 3	KPI 4	KPI 5	KPI 6	KPI 7	KPI 8	KPI 9	KPI1 0	KPI1 1	KPI1 2	Overall	
1	2	s	3	11	4	8	9	10	7	6	5	2	12	1	8	
2	3	t	4	8	1	12	9	11	10	6	5	7	2	3	8	
3	4	l	5	12	4	10	9	8	11	7	6	1	2	3	5	
4	5	s	12	7	8	9	10	6	5	11	4	3	2	1	8	
5	6	s	2	6	5	10	8	9	12	11	7	4	3	1	4	
6	9	s	5	12	1	7	6	10	11	4	3	8	9	2	7	
7	14	l	6	12	7	11	4	5	10	8	9	2	1	3	6	
8	15	l	5	8	4	12	11	9	10	7	6	2	1	3	7	
9	16	s	2	1	12	11	10	4	5	3	6	8	9	7	7	
10	17	l	1	6	5	9	7	11	8	12	10	4	3	2	8	
11	18	t	2	1	6	9	10	7	8	3	11	4	12	5	9	
12	19	q	4	12	5	10	7	6	8	11	9	3	1	2	8	
13	20	q	1	8	4	2	12	10	11	9	6	7	5	3	6	
14	21	q	3	7	4	10	11	12	8	9	6	5	1	2	8	
15	22	q	8	6	11	1	9	10	4	7	5	2	3	12	4	
16	23	q	4	10	3	9	11	12	8	7	6	5	2	1	6	
17	24	l	4	11	5	8	7	6	12	10	9	3	2	1	8	
18	25	l	4	7	5	10	11	12	8	6	9	3	2	1	6	
19	27	p	12	10	3	6	5	7	11	8	9	4	2	1	8	
20	29	p	2	12	1	10	8	7	11	9	6	5	4	3	8	
21	30	p	7	12	5	11	8	9	10	6	4	3	2	1	8	
22	31	p	11	12	2	10	6	5	9	4	3	8	7	1	10	
23	36	p	9	12	6	7	4	3	10	11	8	5	2	1	7	
24	37	t	6	2	1	11	9	10	7	8	4	12	3	5	8	
25	39	t	4	12	6	9	5	10	11	8	7	3	2	1	8	
26	40	t	5	7	1	12	11	10	8	9	4	6	3	2	8	
27	41	t	3	8	2	7	6	4	5	9	1	12	11	10	8	
28	42	t														
29	44	t	10	12	1	11	2	9	5	6	3	8	7	4	8	
30	45	t	10	12	1	11	2	9	5	6	3	8	7	4	8	
31	46	t														Blank
32	47	t	4	12	3	10	9	8	11	5	1	7	2	6	7	
33	48	t	5	6	3	9	8	7	10	2	1	11	12	4	9	
34	49	t	1	12	6	7	5	4	8	9	3	10	11	2	9	
35	50	p	10	12	1	3	4	5	11	6	7	8	2	9	7	
36	51	l	5	9	4	8	7	6	10	3	2	11	12	1	9	
37	52	q	4	12	10	7	5	6	9	11	8	2	3	1	7	
38	53	t	6	4	9	3	2	1	5	7	8	10	12	11	9	
39	57	q	2	6	3	12	10	11	7	8	4	5	1	9	7	
40	58	l	1	12	5	6	7	8	9	11	10	4	3	2	5	
41	59	q														Blank
42	60	t	5	12	4	9	8	7	11	10	3	6	2	1	7	
43	61	t	11	8	6	10	9	5	12	4	7	3	2	1	8	
44	62	p	8	5	12	1	3	2	4	7	6	11	10	9	6	
45	64	p	8	12	3	7	6	2	11	10	9	5	4	1	8	
46	65	p	7	12	6	9	4	3	10	11	8	5	1	2	8	
47	66	p	12	10	3	6	5	7	11	8	9	4	2	1	8	
48	67	t	4	8	1	12	10	11	9	7	6	5	3	2	7	
49	68	t	2	11	1	12	9	7	3	4	6	10	5	8	6	
50	69	p	6	11	7	12	4	3	10	9	8	5	1	2	10	
51	70	p	9	1	6	5	4	3	2	7	11	8	12	10	2	
52	71	p														Blank
53	72	p	1	10	9	6	5	4	12	11	2	7	8	3	10	
54	73	t														Blank
55	74	q	1	2	7	6	12	11	10	8	9	5	4	3	6	
56	75	q														Blank
57	76	l	8	11	7	12	4	6	5	10	9	2	3	1	10	
58	77	t														Blank
59	78	q	2	11	6	8	5	4	12	10	9	7	1	3	7	