

The Impact of Real Time Shop floor information on Operational Decision making

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MASTERS DEGREE IN BUSINESS ADMINISTRATION,

By

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Declaration of own work

I, Martin Vermaak, declare that this research report is my own work except as indicated in the references made. It is submitted in partial fulfilment of the requirements for the Masters Degree in Business Administration to the Graduate School of Business leadership of the University of South Africa.

Martin Vermaak

02 May 2011

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Executive Summary

The concept of Operational decision making is not new, but in the context of Enterprise Resource Planning implementation as is the case at PFK Electronics (PTY) Ltd., it becomes part of what ERP process that makes organisations more competitive and profitable as Wallace and Kremzar (2001) comment, *“Effective forecasting, planning, and scheduling is fundamental to productivity and ERP is a fundamental way to achieve it. Properly implementing ERP will give you a competitive advantage and help you run your business more effectively, efficiently and responsively.”*

The Operational decision making process that forms part of the research question is a process known as Sales and Operational Planning process (SOP's). The research paper is looking at how Real Time Shop floor information can impact on the decision making process, as Wallace and Kremzar (2001: 165) state that this is the most important element in making ERP systems work.

The study looks at what information is required to make effective decisions in the SOP's process and how the respondents perceive information quality, its value and the impact on decision making in the SOP's process. The research sought to further investigate a diverse demographic population, the behavioural culture within the organisation and their perception on having this information in real time directly from the shop floor. Data was collected via a survey questionnaire and an interview process which also required the review of organisational documentation where available.

The research aimed to investigate what information Operations (SOP's) need to make effective decisions to meet the organisational strategic objectives and to determine the best means of obtaining and communicating the information to managers. Developing this further the research was then broken down into three objectives:

- To investigate 'what' information sales and operations managers need in order to make effective decisions that will have an impact on them meeting strategic performance objectives.

- To evaluate 'how' real time shop floor information can improve the decision making process in Operations in meeting strategic objectives; by understanding the types and methods used in decision making and the significance of time on information.
- To recommend suitable Information Communication Technology (ICT) systems to obtain and communicate information to managers effectively within operations.

During this process time constraints were of a concern, which manifested in objective three not being able to be completed to the satisfaction of the researcher. However the research process, which included the survey and interviews of respondents, the researcher felt that respondents were honest and open in expressing their views which adds to the validity and reliability of the research.

The results showed that there was a clear understanding of the topic amongst the respondents. It showed that the respondents had a good understanding of information and its importance in meeting strategic objectives by making better decisions. It became clear that ERP was generally working well but that timeliness of information was the biggest obstacle in meeting strategic objectives in balancing supply and demand. The research identified the information necessary for the SOP's process to be effective and it also showed the impact of having real time shop floor information available to the decision making process. It also showed that there would be other benefits as performance could also be improved by having real time performance indicators that are used to set the pace and common goal.

The report also identified some cultural differences between PFK electronics culture and NUMSA unionised employees culture and the impact it has on relationships and communication.

The report concludes with the research question being answered and with a recommendation that the single most important means of improving operational effectiveness is going to be to improve the quality of information used in decision

making. The research has shown that getting this information in 'real time' or as close as possible to real time is the best means of improving the quality of information and its impact on management decisions. It is further recommended to investigate the implementation of systems such as Manufacturing Execution Systems to link the shop floor directly into the current ERP system and lastly to find a means of bridging the cultural differences between NUMSA unionised employees and PFK behavioural culture.

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Chapter 1: Background to the problem.

This research paper is aimed to better understand how PFK Electronics (PTY) Ltd. employees perceive the impact of having real time shop floor information by investigating the operational decision making process followed to achieve strategic performance objectives and operational effectiveness.

As Michael E. Porter (1996: 78) cites that, *“The operational agenda involves continual improvement everywhere there are no trade-offs. Failure to do this creates vulnerability even for companies with a good strategy. The operational agenda is the proper place for constant change, flexibility, and relentless efforts to achieve best practice.”*

As Porter (1996) mentions it is a constant drive within operations to work towards efficiency and effectiveness through continuous improvement. It is with this in mind that this research paper is looking towards finding answers on how effectiveness can be improved within operational decision making based on the information utilised in achieving strategic objectives.

1.1. The Problem in context.

PFK Electronics (Pty) Ltd (2010) was established in 1985 by three electronics engineers who were working in a very large military design and manufacturing environment doing specialist radio designs for military use. In the early 1980's in South Africa, electronics development was predominately happening in the military environment because of sanctions imposed during the apartheid era and the investment needed, which only large state sponsored organizations could afford.

The three founding engineers took a large gamble going from well paid jobs in a very well funded company to going on their own and working from a garage they had hired to develop a commercial radio system. Their funding came from a wealthy family who had a need for commercial two-way radio systems and they approached the founding engineers to develop these radios and become partners in their business. The original founders had, at that point, no manufacturing background or experience and were

purely design specialists in the electronics field, with no intention of being a manufacturer of electronic products.

The three engineers developed the radio system and then found that the potential market for their radio system no longer existed, due to there being many established suppliers of radio systems for commercial use coming into the South African market because of the changing political environment. The founding engineers then searched for a new market; and decided, because of their skill in electronics design, to design vehicle security systems that could be fitted to any vehicle. They went about developing and manufacturing vehicle security systems (Alarms and Immobilizers) for the South African vehicle aftermarket in a period where mechanical systems (Gear locks) were prevalent, as South Africa experienced a huge upsurge in vehicle theft. In being one of the first to do this in the South African market, their business grew at around 30% growth rate per annum. This meant that not only did they design electronic products but they were now becoming a growing manufacturer of electronic products. By the third year they had to move to larger factory facilities because, by this stage, they had grown to over 30 employees. During this time two other competitors started operating as this was a growing market in South Africa because of the high vehicle theft rates in the early 1990's.

PFK Electronics (PTY) Ltd. started distributing their products through existing fitment centres i.e. centres for car audio and air-conditioning aftermarket fitment for customers and dealerships. This was considered a logical means of selling large volumes of products and making the business viable. PFK Electronics was now becoming a growing manufacturer of electronic products rather than purely only a design firm. Having chosen a route to market through the fitment distribution channel, customers required that stock be available off the shelf.

What this resulted in was a situation where PFK management entered supply chain management challenges as fitment centres could take from 5 or 500 parts on an ad hoc basis. This in a manufacturing context caused massive demands in raw material inventory being kept and finished goods inventory to ensure that stock was always

available. The founding engineers subsequently had also to look at more conventional manufacturing techniques to realize quality and capacity growth. PFK electronics had to move again in 1992 as manufacturing climbed to over 100 employees. Manufacturing during this time was driven through the skill of individuals who decided what components had to be procured, how many and when product would be produced. ICT systems were very expensive and highly sophisticated and were not deployed into manufacturing at PFK (2010) yet. By the early 1990's personal computers were being utilized in a very limited way through the use of simple spreadsheets to assist in the planning and commercial management of PFK manufacturing.

The PFK (2010) culture created by the original founders was always to be as advanced as was economically possible and they introduced technology in manufacturing as and when they could afford it, to aid in the planning and procurement of components whilst the factory capacity and planning was still very dependent on manual systems. The organization grew year on year and started entering markets such as Original Equipment Manufacturers (OEM's) of vehicles like Delta Motor Corporation (Today General Motors) and Volkswagen SA. During the late 1990's and early 2000's, due to PFK's market share in the vehicle security market, local manufacturers started working with PFK as they were looking for local content manufacturers, which they required under government's Motor Industry Development Program (MIDP). PFK Electronics became successful in this environment, winning many quality and supplier awards. However the OEM's had penalty clauses in supply agreements which were severe and furthermore, could do potential serious harm to the organization's reputation. The manufacturing structure at this point was still very much only production, with procurement, planning and research and development all being independent departments. PFK management, realizing that they needed a better means of controlling the supply chain and manufacturing build schedule, decided to invest in a material requirements planning (MRP) system. What this system allowed was for all of the inventory requirements to be loaded into a database system which would define them in detail, and with the OEM customers being able to provide some prediction of their demand, the MRP system could calculate which components to buy and when. It

also had a very limited ability to suggest what products to build by when, assuming infinite capacity.

PFK Management, at this point, decided it needed to be more efficient and effective in manufacturing as in the early 2000's their growth was coming from OEM's business. OEM's were demanding better systems to improve quality and to remove the supply risk of defaulting deliveries which caused production line stoppages in their production facilities.

PFK management restructured manufacturing and brought in more skills from resources experienced in manufacturing systems. They employed industrial engineers and a production manager from a company that had introduced Japanese manufacturing methods using 'kanban' in the hope that this in conjunction with the MRP system would improve performance. However, after two more years (2006), management realized that the situation had made an improvement in the quality of products manufactured but it had still not resolved the situation of component availability and the massive effort required to manage capacity, which also resulted in high manufacturing costs. Bills of materials became even more complex and consisted of hundreds of components per product due to the migration from analogue devices to digital devices.

Manufacturing costs was also now becoming an issue as product margins came under pressure from local and imported products supplied by competitors. PFK's management, at this point, decided that they had to do something significantly different and employed consultants to solve the MRP problem, thinking that this was the issue. After a period of 6 months the consultants advised PFK to change to an Enterprise Resource Planning (ERP) system namely Syspro (2011).

The planning and migration to the new system software (Syspro, 2011) took another two years. By late 2008 with the new system in place nothing in manufacturing had yet improved. There was still massive component stock shortages and disruption to production resulting in missed sales and deliveries to customers. PFK executive directors then realized that they needed to change the organization from being a heavily

weighted engineering driven management team to a team made up of commercial and manufacturing experts who could look at the manufacturing system as a complete process. These experts could identify the root cause of the problems in manufacturing from component availability to production schedules and meeting customer deliveries whilst achieving quality, speed and cost dimensions to make manufacturing more competitive and productive.

It is within this context that the mandate was received to investigate the problem described above which resulted in the researcher taking on this research problem.

1.2. Problem Review.

PFK management made significant changes to the top structure of organization by appointing a new managing director and a new operations director. The managing director had a financial background and the operational director had a manufacturing systems background gained in the electronics manufacturing environment.

These changes effectively changing the style of management from a engineering driven style to a manufacturing systems style. Some of the changes experienced were the combining of reporting of functions such as procurement, production and planning into a single department 'Operations'. This gave them a single focus, getting to the root cause of missed deliveries.

Stakeholders interested in the effectiveness of operations started a root cause process by brainstorming (Appendix A) and the results started putting a picture together of the challenge facing PFK manufacturing.

The problem was reviewed by identifying that there was no clear understanding of information, its value and quality and how in the decision making processes this was used. It became clear to the researcher through further discussions after the brainstorming session, that team members with operations decision making responsibilities were not conscious of how decisions were being made; and therefore they had no understanding of how they could become more effective in achieving performance objectives.

From the brainstorming and grouping of ideas with the team, five potential themes were identified. While reflecting on these themes, additional comments came to the fore

- **Information:** This is linked into the decision making process and is the information required to make decisions. Some of the issues would be the availability of this information and accessibility. Further more the accuracy of this information and from whom it is sourced, and whether the sources are reliable, needs also to be considered. The question is whether it can be sourced in real-time from performance; and whether everyone has access to the same source?
- **Strategic planning:** The question is, how does the problem as defined and the topic fall within the strategic plans of the organisation and within operations? Furthermore, would the project be appropriate in relation to the strategic plans (Appendix F) of the organisation as reflected in the Compass aligned performance system (C@ps, 2011).
- **Performance measurement:** This would apply to the research project because to make decisions not only information is needed, but also performance measurements to decide on the effectiveness of the decisions made, which are linked back to strategic objectives of organisation (Appendix F).
- **Decision making:** As can be seen from brainstorming session (Appendix A), numerous ideas came out of this theme. For example, the type of decisions being made, whether they are structured and whether rules could be applied to lessons learnt to improve decision making, to the point where it improves operations performance. The question remains whether decision makers consciously consider the decision making process or is it intuitive and are they aware of the impact on quality, speed and costs on PFK as a organisation.
- **Communication:** This includes how effective information and decisions are communicated within the organisation and especially within operations. While operations cannot function in isolation there is a logical conclusion that

communication should be throughout the organisation. In the brainstorm session this was especially true between operations and the sales departments.

1.3. Problem statement.

PFK Electronics had gone through phases of growth both in the development of product and in establishing manufacturing process that could meet the requirements of customers over time. It is through the realisation that change was required in the focus of manufacturing that a structure was created to address the effectiveness of manufacturing. With the context set within PFK manufacturing the problem statement or aim will be,

“To investigate what information Operations (SOP’s) need to make effective decisions to meet the organisational strategic objectives and to determine the best means of obtaining and communicating the information to managers.”

Following on from this, the following statement was decided on as a question that needs to be answered, given the development of the area of interest and the ability of the statement to meet Hofstee’s (2006:26) criteria for a good thesis statement, namely:

“Will having core real time shop floor information allow operations to achieve strategic objectives by improving decision making?”

1.4. Research objectives.

From the problem statement and the ideas and themes established from the brainstorming session and in conjunction with relevant stakeholders, the objectives of the study were:

- To investigate ‘what’ information sales and operations managers need in order to make effective decisions that will have an impact on them meeting strategic

performance objectives. The data/information is specifically linked to Sales and Operational Planning (SOP's) objectives. (Appendix F).

- To evaluate 'how' real time shop floor information can improve the decision making process in Operations in meeting strategic objectives; by understanding the types and methods used in decision making and the significance of time on information.
- To recommend suitable Information Communication Technology (ICT) systems to obtain and communicate information to managers effectively within operations.

1.5. Delimitations and Limitations.

From the research objectives, the scope of the research will be limited to,

- 'What' information Operations (Planning/procurement/production) require to make decisions which will meet the strategic objectives of >95% On Time In Full (OTIF), Sales customer demand. (Appendix F).
- How the decision making will be impacted by having real time information available.
- Recommending suitable Information Communication Technology (ICT) systems to obtain and communicate this information to operations managers.
- The study will be limited to the Commercial manager, Forecasting clerk, Systems manager(ERP), Master scheduler, Production manager, Jnr Production Managers, Production line team leaders.

The researcher wishes to define the limitations of the research as follows,

- This research does not consider decision making that is done generally within operations including support functions but is limited to the information and decision making that is required to meet strategic performance criteria of PFK (2010) relative to meeting customer demand.(Sales and Operational planning).
- The research results are limited by the skills and knowledge of people forming part of the population sampled. The study relies on the response of these

respondents and the risk is that those involved will not provide quality data from which analysis can be derived. As the population consists of PFK Electronics (Pty) Ltd. sales and operational management and production floor line management it is heavily reliant on these people having the skill to answer and provide relevant information to the research problem. This brings into play the validity of the data respondents provide to the researcher's survey and interview questions.

- Another limitation is that of the researcher's understanding of the overall Sales and Operational Planning process.

1.6. Importance and benefits of the study.

This research results will be of importance to PFK (2010) as an organisation as it will pave the way for future efficiency and effectiveness of operations. It will create focus on management models such as, strategic planning, communication, decision making, performance management which will grow the knowledge base and introduce good practices within operations. The importance of the research will be to establish what information it is that PFK Operations needs to become effective and efficient through its decision making processes. This will impact the PFK Organisational strategy and its competitiveness by impacting flexibility, speed, quality and cost.

The benefits would be for PFK Operations to become a key component in PFK strategic success by being an efficient and effective manufacturer of electronic products, as is cited by Michael Porter (1996: 78), Harvard Business school professor, *"Managers must clearly distinguish operational effectiveness from strategy. Both are essential, but the two agendas are different. The operational agenda involves continual improvement everywhere - there are no trade-offs. Failure to do this creates vulnerability even for companies with a good strategy. The operational agenda is the proper place for constant change, flexibility, and relentless efforts to achieve best practice. In contrast, the strategic agenda is the right place for defining a unique position, making clear trade-offs, and tightening fit."*

In summary PFK Electronics (Pty) Ltd. (2010) 'bottom line profits' would benefit from the research study in the following way,

- *Informed*: The Sales and Operational Planning process will be informed ; and that would identify 'what' information is needed to ensure effective and efficient decision making. This will result in lowering the risk of missed deliveries resulting in lost sales.
- *Flexibility*: The impact of customer demand changes and how operations can respond in the most efficient and effective manner will be understood.
- *Speed*: The speed with which operations can respond in meeting deliverables, remembering less time spent means less cost spent and quicker deliveries, by providing understanding of decision models typically used and risks associated with them.
- *Cost*: Efficiency must have an impact on costs such as the cost of holding inventory (working capital), keeping the wrong type of inventory and minimising value add wasted.
- *Quality*: Fewer disruptions to agreed process and quality controls will result in improved quality yields and product quality. This will provide a higher degree of customer satisfaction and loyalty to the brand.

1.7. Summary.

PFK Electronics has developed over 25 years both in design and manufacturing capabilities, and has now reached a point where operational effectiveness needs focus and the new structure that was implemented is aligned to do this. The objectives of the research have been developed to assist in answering the thesis question, which is:

“Will having core real time shop floor information allow operations to achieve strategic objectives by improving decision making?”

The next chapter discusses the management theory around the themes that form the framework of the research.

Chapter 2: Theoretical consideration

2.1. Introduction.

The problem statement and the subsequent problem review resulted in five themes being identified and three research objectives, within the PFK (2010) context. Looking at the research problem there are some management models that have been designed. In this chapter the problem will be analysed within the context of PFK Electronics (Pty) Ltd.

Out of the problem review the following five themes were established relevant to the PFK (2010) context namely, Information; Strategic planning; Performance measurement; Decision making and Communication. The researcher will take a critical reflective view on theory and its impact on PFK operations (2010).

2.2. Problem analysis and business case.

2.2.1. Information:

Looking into the theory on what makes up 'information' Martin and Powell (1992: 78) clearly define the misconception that regularly plagues PFK (2010) in that managers do not always understand the differences between 'data' and 'information'. Martin and Powell (1992: 78) clarify this as cited, "*Data is the raw material of organisational life; it consists of disconnected numbers, words, symbols and syllables relating to the events and processes of the business. Data on its own can serve little purpose; in fact a serious problem for the manager is the need to make sense of the deluge of data that threatens to overwhelm him or her in the normal course of the job.*"

This is such an important citation as it reflects the problem within the context of PFK (2010). PFK (2010) operations have large amounts of data, constantly being published from various sources such as from the finance departments, who are attempting to police efficiency and effectiveness. Also from the quality departments who are trying to

quantify product risk by expressing production standards of performance in parts per million defects etc.

Stapleton (2007: 78) further theorises that data requires some kind of interpretation before it can be understood and used. Stapleton (2007: 78) defines information as; *“Information is data that has been analysed or interpreted in some way in order to communicate meaning to the recipient.”* It is this statement that brings into context the requirement for PFK (2010), as it has been noted that operations is supplied reams of data from all sorts of sources that is expected to be used in the decision making process in an attempt to improve the performance of the operations department. Within that is contained what the theorists explain i.e., that this data requires some interpretation before it will be useful or can be used in decision making. Stapleton (2007: 78) theorises that, *“Without collecting and making sense of information, you could not make decisions effectively, manage other peoples work or communicate effectively.”*

In the context of the topic as it relates to PFK (2010) Stapleton (2007: 79) quotes Simon and March as saying, *“...managers attempt to be rational in their decision making, but are limited in their ability to do so by the quality of the information available to them,”* Taking a critical look at the operational decision making processes within PFK (2010) , it could be said that the relevance of this statement is exactly the purpose of the research viz. to determine ‘what’ information is required within the scope of the research project, as well as another vital aspect, the quality of said information.

Stapleton (2007: 80) theorises that there is ‘hard’ and ‘soft’ information’ and that it is important to know what constitutes good information. This is particularly relevant to the present research. The following statement, made by Stapleton (2007: 80) goes further to show the relevance of theory on information, *“Information should not be collected or passed on for its own sake, but only if it leads to increased understanding and added value.”* Within the context of PFK (2010), the problem of departments such as finance

and quality is that they with the best intentions provide reams of data that has had no interpretation done. This can easily contribute to the inefficiency and ineffectiveness of decision making in operations because it can create a tendency to attempt to use data that adds no value to the process or creating constraints in resources through 'analysis paralyse'. The quality of the information in theory is defined Stapleton (2007: 82) as being made up of ten criteria namely, “

1. *Relevance*
2. *Clarity*
3. *Accuracy and precision*
4. *Completeness*
5. *Trustworthiness*
6. *Conciseness*
7. *Timeliness*
8. *Communication to the right person*
9. *Communication to the right channel*
10. *Value.*”

Items 1-7 are detail about the information quality, but items 8-10 are relevant in the context of this research, in the communication theme, and in its value as part of decision making process.

Stapleton (2007: 87) expresses the point of view that communication of the information is only useful if it has managed to reach those who need it; otherwise the effort in producing it was wasted. Within PFK (2010) it is plausible that there are instances where information does not reach those that require it and the effort that went into obtaining the information is lost.

As was established in the problem statement and out of the objectives, Stapleton (2007: 88) provides theory on communication using the right channel, by stating that channel of communication needs to consider the nature and purpose of the information, speed of transmission required and users requirements. Additionally Stapleton (2007: 88) states

that choosing the most appropriate channel is the sign of a good communicator. In terms of PFK (2010), it is likely to impact on the third objective once it has been decided what will be communicated. It is likely to include the use of the current Enterprise Resource Planning (ERP) system deployed at PFK (2010), namely Syspro (2011). Stapleton (2007: 89) underpins the use of this information system as is used in PFK (2010) systems by stating that, "...all information systems must be computer based. Formal management information systems provide information to support management decision making. The best decisions are often made by those managers who are directly involved in the information systems that provide them with the information they need to make decisions." This statement needs to be tested through the survey questionnaire in the case of PFK (2010) as it leans strongly towards the research objective of information and its impact on decision making.

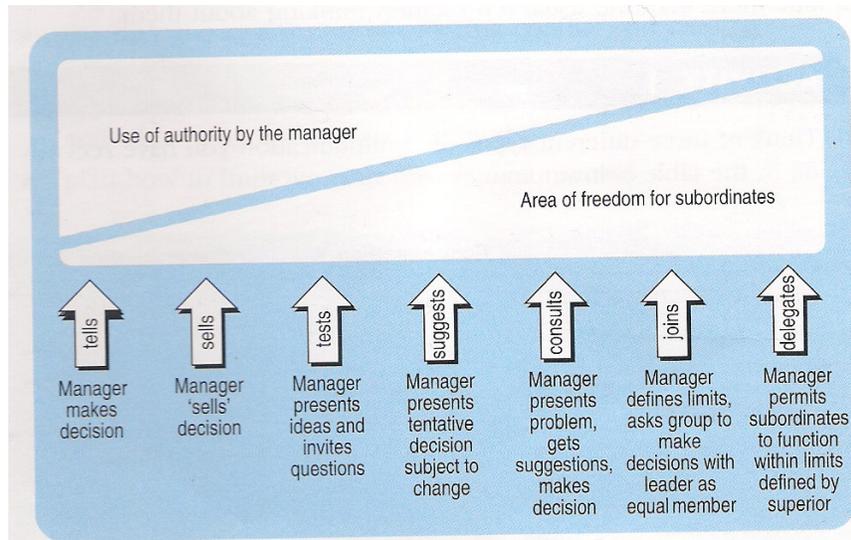
2.2.2. Communication: This follows on logically from theme 1 in that once establishing 'what' information it is that PFK (2010) requires in making effective and efficient decisions; it needs to be communicated to the Sales and Operational teams that are making those decisions.

Communication as a theme is very complex as is noted by Cameron (2006: 7), as it is not merely the transfer of information but there are all sorts of messages beyond the mere facts that are transmitted. Cameron (2006:7) theorises further saying that this defines those communicating and the situation itself, essentially theorising that communication lies at the heart of the socialising process and as such forms a central part of knowledge creation.

Within the confines of PFK (2010) it is communication that makes knowledge transfer possible and with PFK (2010) being a technology company , without understanding models of communication , there will be no way that improvements could be made in the communication of information beyond the mere transfer of facts. It is the style of communication that is accepted within PFK (2010) that will define the effectiveness of the communication and thus its impact on performance of operations.

Tannenbaum and Schmidt (1973: 10) define classic management styles built on different styles of communication as illustrated in Figure 2.1.

Figure 2.1. Management styles

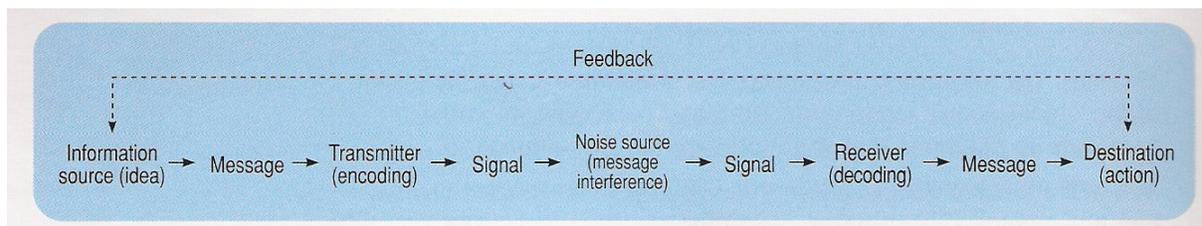


Source: Tannenbaum and Schmidt (1973: 10).

As is cited by Tannenbaum and Schmidt (1973: 10), their model suggests that the appropriate style will depend on the situation.

It is essential to take a critical reflective view on PFK (2010) communication, using models of communication, to establish if communication can be improved in the operational environment based on understanding of the elements within a communication model. One of the models that is explored in theory is the communication model as developed by Shannon and Weaver (1949: 11), illustrated in Figure 2.2.

Figure 2.2.: Simple communication model



Source: Shannon and Weaver (1949: 11)

Using this model (Fig 2.2.) as a basis for communication theory Deaux, Dane and Wrightsman (1993: 12) suggest three shifts of emphasis on the ideas to establish the effectiveness of communication namely, “

- *An awareness of communication as an interaction between two parties,*
- *A focus on the expectations and understandings of ‘self’ and ‘context’ that each party brings to the interaction.*
- *A realisation that effective communication is only possible where individuals share a certain amount of common ground.”*

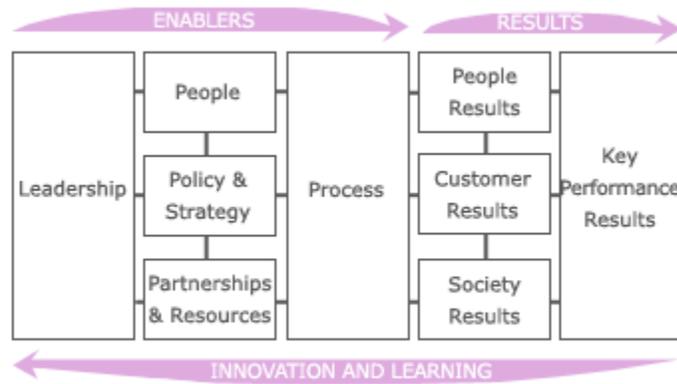
2.2.3. Strategic planning: PFK (2010) uses the European Foundation for Quality Management (EFQM) business excellence model as cited by Fenton-O’Creevy (2007a: 24). This is the framework out of which PFK documents the enablers by using the Compass Aligned Performance system (C@ps, 2011) and measures the results using a balanced score card (Fenton-O’Creevy, 2007b: 83). The EFQM model talks about five enablers, ‘Leadership; Policy & Strategy; People management; partnerships & resources’. It is through PFK management that ‘leadership’ has defined the ‘strategy’ using C@PS (2011) and the reason why PFK (2010) uses this model is probably because management realised that a holistic view needs to be taken to ensure that the organisation, as a unit, is aligned to common goals and objectives Furthermore, the EFQM model, as is cited by Fenton-O’Creevy (2007a: 22) confirms this view, “*This model, like the balanced score card, takes a holistic approach to performance and assumes that multiple stakeholders must be satisfied simultaneously.*” It becomes clear from this statement that this theme is relevant to the research topic, as the decision making that is required in operations covers stakeholders from production, planning, procurement and sales. This team will holistically need to make decisions that impact on the customer delivery (OTIF) which is one of the strategic objectives of the organisation, as stipulated in the PFK C@ps document.

The EFQM model (Fenton-O’Creevy, 2007a: 23) is shown in Figure 2.3, is defined as being a useful framework to,

- develop a shared vision and goals

- help identify and understand the systemic nature of business, its key linkages and cause and effect relationships.

Figure 2.3: EFQM model



Source: EFQM (2010).

Linking to the strategic planning as the EFQM model suggests is the theme of performance measurement which is the next theme to be explored as relevant to the problem review.

2.2.4. Performance measurement: Within the context of PFK (2010) performance measurement of operations is facilitated through the balanced score card, as it allows for a holistic view of how different performance measures are related as was described by Fenton-O’Creedy (2007a: 24) under the ‘Results’ dimension of the EFQM model. (Figure 2.3.)

Defining a Performance measurement as is cited by Fenton-O’Creedy (2007b: 83) would differ depending on which discipline it is being applied, e.g. Finance would measure key ratios, quality would measure Statistical Process control (SPC) etc. However Fenton-O’Creedy (2007b: 83) makes one very important observation by saying that, “*First, effective performance from one perspective may depend on effective performance from another.*” Fenton-O’Creedy (2007b: 83) goes on further to say that to understand how these different perspectives work together would only be understood if the strategic goals of the organisation are understood.

Fenton-O’Creevy (2007a: 24) would suggest, as is shown in the EFQM model, that there are relationships that would exist and that decision making would impact on each. To get a holistic view on how well an organisation performs Fenton-O’Creevy (2007b: 83) cites, *“Unless measures of performance are linked to an organisation’s goals we are only in a position to consider economy or efficiency. To understand performance effectiveness we need to consider how each perspective contributes to the achievement of strategic goals.”*

2.2.5. Decision making: Decision making and the information theme are seen to be the two most critical themes to form part of the research topic as it also covers two of the three objectives identified out of the problem review process.

In terms of decision making the problem statement refers specifically to Sales and Operational planning (SOP’s) decision making.

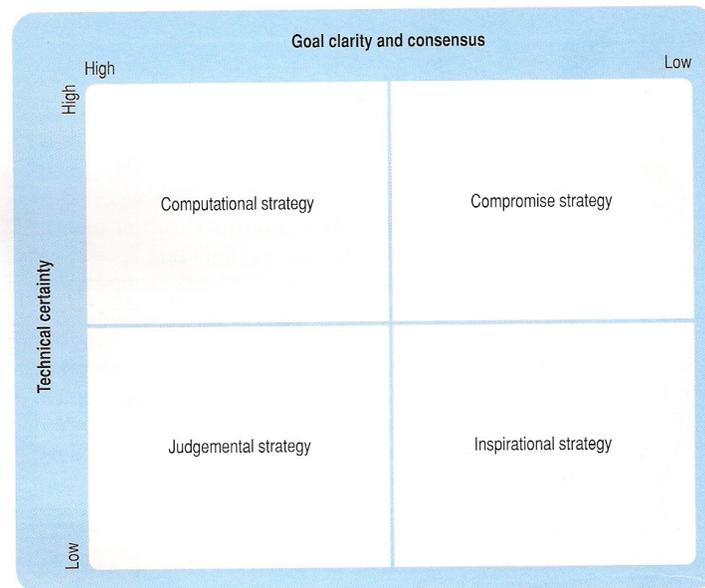
Mintzberg is cited by Stapleton (2006: 7), as identifying the decision making role as one of the three distinguishing features of management. Stapleton (2006: 7) theories that the type of decision you make will depend on the type of organisation and level of responsibility, whereby typically operational decisions are taken by first line managers as is typically the situation within the PFK (2010) operational environment. As was established from the problem review, one of the objectives is to understand how the decision making process will be improved, therefore knowing the type of decision making style to be utilised would help.

Decision making within the PFK context is likely to be what the Stapleton (2006: 14) describes as; *“Operational decisions are often routine. They are generally well served by a rational approach.”* March (1978: 19) argued that, *“...decision processes are often more complicated, confused and erratic than either theorists or managers like to admit.”*

Thompson (1967: 32) developed a useful approach to decision making styles in which he presents a contingency theory on decision making. As is cited by Thompson (2006:

32), “The making of decisions involves beliefs or assumptions as to what will happen if one course is taken rather than another, and preferences as to what is most desirable.” Thomson (1967: 33) illustrates this as follows in Figure 2.4.

Figure 2.4.: Decision making context



Source: Stapleton (2006: 34).

As is illustrated in Figure 2.4, there are essentially four styles defined using ‘preferences regarding possible outcomes’ and ‘beliefs about cause/effect relations’. Out of the modified version of Thompson’s matrix (2006: 34), four strategies’s emerged as is cited by Stapleton (2006: 34) namely,

- Computational strategy – Top left – High goal clarity and consensus with a high technical certainty on how to achieve outcome, approximates the rational model.
- Judgemental strategy – involves decision processes based on judgement and experimentation, but within a context of goal consensus. Organisational learning.
- Compromise strategy- Political decision making- with bargaining and compromise the obvious way to resolve differences over goals, bounded

rationality is likely to mean that managers aim for satisfactory rather than best outcomes.

- Inspirational strategy – where managers - little consensus is achieved in goals, and how they could be achieved. Affirmation of shared values and identity are likely to be important to legitimise the process. It will be an inspired leap in the dark.

March (1978: 21) also made a suggestion that managers need to be opportunistic and flexible as there is a risk of '*decisional bias*' intervening. Within the PFK (2010) environment it is extremely vital that managers stay flexible as it was identified as a competitive advantage to prevent a situation where customer's cannot be accommodated because of inflexibility and where customer loyalty and providing opportunity for competitors to find entry to PFK (2010) customer logistics, are risked.

It is however what Stapleton (2006: 22) refers to that will have impact on flexibility, viz. "*An internal environment that encourages discussion can help to overcome the adverse effects of decisional bias. Organisational culture is, of course, the key here.*"

Stapleton cites (2006: 26): "*In a rapidly changing environment successful organisations will be those that can respond promptly and consistently to opportunities and threats. They have to become, in other words, learning organisations.*"

Stapleton (2006: 26) explains that it is the pooling of information about emerging problems and formulation of new knowledge and beliefs that emphasises organisational learning. Stapleton further theorises that this knowledge is then encoded in operating procedures and guidelines so it can be shared. It therefore follows that it forms an important part of implementing decisions as a routine task of adjusting standard procedures to embody and express what the organisation has learnt. Stapleton (2006: 26) stipulates that this is important: "*This is particularly important in fast-moving, knowledge based industries, where organisations need to draw on diverse views and expertise.*"

PFK (2010) is a technology based organisation that has complex demand planning; which has been made even more complicated through the influence of the recession; which has resulted in customers having even less confidence in planning their demand in advance, which conflicts with the long lead time of components impacting on procurement.

2.3. Summary.

From the problem statement five themes were identified and these were reviewed and analysed to unravel the complexity of the problem statement. This allowed for the problem to be critically unravelled in the PFK (2010) Sales and Operational Planning environment.

This identified aspects of the themes that relate to what the theorists had to say on the topics. The drafting of the survey questions and interview questions allows the three objectives identified, to be achieved and thereby works towards answering the research question.

Chapter 3: Literature review.

3.1. Introduction.

This literature review will provide an academic case and build on the problem as unravelled in chapter 2, by focusing on the two main themes, information and decision making objectives, that were identified out of the problem statement analysis. Within the two main themes the other three themes will be explored to work towards the objectives of the research project.

There is clearly, as seen from the problem review, a relationship between information, communication and decision making models. This is further supported with what Miller (2009: 139) has to say about decisions which brings in the time and quality of the information dimension, which gives an interesting link with the research problem, on the impact of information on the decision making process, "*Decisions might be made after months of information gathering and deliberation or be made in an instant with little or no consideration.*"

3.2. Information theme.

Fisher (2001: 75) states that information is a core asset of organisations and that "*Information is becoming the heart and soul of every business.*" This in the context of the PFK (2010) problem is exactly what is of concern. Information and its use in the decision making processes that impact's on operational performance, is relevant.

Looking at the 'value of information' as is cited by Badenoch, Reid, Burton, Gibb and Oppenheim(1994: 9), they say it is a neglected and under researched subject and it is difficult to get to an agreed definition of what the terms mean. Badenoch *et al.* (1994: 10) go on further to cite Arrow's (1984) definition, "*that which reduces uncertainty*".

Blumenthal (1969) is cited by Badenoch *et al.* (1994: 11) as defining information as, "*Data recorded, classified, organized, related or interpreted within context to convey*

meaning.” However, it is what Burch (1974), cited in Badenoch *et al.* (1994: 11), defines as information, “*The result of modelling, formatting, organizing or converting data in a way that increases the level of knowledge for its recipient.*” that aides in the definition of information as taking data and interpreting this data, thus converting data into information. Burch (1974) cited in Badenoch *et al.* (1994: 11), links knowledge and information by stating that “*Information supplies knowledge*”.

Checkland and Howell, cited by Hinton (2006: 63), support the definitions of Blumenthal (1969) and Burch (1974) as cited by Badenoch *et al.* 1994: 11, by confirming that the idea of ‘information’ being selected data to which meaning has been attributed in a particular context. Checkland and Howel, cited by Hinton (2006: 63), say this is the basic premise on which information systems exist to serve and support people taking purposeful action. This purposeful action, in the context of this research, is decision making, using information derived from information systems.

Badenoch *et al.* (1994: 16) describe value as being like beauty where the value will lie in the eye of the beholder, and that fundamentally value will be attributed by a person, not forgetting that individuals do come together and share information. So here Badenoch *et al.* (1994) are making reference to value being subjective, therefore implying that value of information will depend on the context within which it is viewed. Badenoch *et al.* (1994: 16) make a very simplistic yet important analogy which certainly must pertain to the PFK (2010) context. They refer to a stock broker who gets information on a take-over bid of a company. The time when this information was received would have an immense impact on the value of the information, for instance, it would be more valuable the day before the bid than the day after the bid as is described by Badenoch *et al.* (1994:16), thus making a very important statement about the value of information:., “*Hence, there is a relationship between timeliness and value which is also dependent on context.*”

Badenoch *et al.* (1994: 17) go on further to explain that this then brings about two principle theoretical issues. The first being concerns about the relationship between the personal experience of information and its value (relevance within context). The second is concerned with trying to describe the context of individual users of this information by finding out what criteria they use to assess the value of the information.

Feeney *et al.* (1994: 17) talks about relevance being depicted as an event referring to the simple theory of relevance proposed by Sperber and Wilson (1986) , “...*where it is the product of contextual effects modified by the processing effort expended to acquire them.*” As Badenoch *et al.* (1994: 17) so clearly explains, this theory essentially is saying that the more effort it takes to process information within the same context , the less relevant the individual finds information, thereby defining the individual’s assessment of information as the value within the context.

The second theoretical issue mentioned about the context as Badenoch *et al.* (1994: 17) writes, can become very complex in the theoretical sense, but the simplest way would be to ask individuals about the context and the criteria they use to assess the value of the information. Feeney *et al.* (1994: 17) mention that it goes to the ‘persons state of knowledge.’

Looking at the value of information from an organizations perspective, Badenoch *et al.* (1994: 33) cites that traditionally information activities were viewed by organisations as overheads, partly because of a lack of understanding about the role and importance of information. Badenoch *et al.* (1994: 33) goes on further to comment that the costs can no longer be considered as unallocated or unquantifiable due to proportion of costs associated with running an organisation.

Ahituv (1989) as cited by Badenoch *et al.* (1994: 33) describes three generic approaches to the evaluation of information within organisations. These are , the normative approach, the realistic approach and the perceived subjective approach. Badenoch *et al.* (1994: 33) describes these as,

- Normative approach requires rigorous modelling and precise measuring of all factors, it is based on assumptions that may or may not relate to the real life situation.
- The realistic approach, seeks to measure the effect of information use on the decision makers, requiring the performance to be measured before and after the receipt of information, a technique that is both artificial and unrealistic.
- Subjective approach which is based on the assumption that users can recognize the benefits they gain from the information, and that they can translate this into a numeric scale.

In terms of the researchers objectives the subjective approach would align with finding the value of information within the organisation. Badenoch *et al.* (1994: 33) mention that the problem is that, rarely, are stakeholders, such as senior managers, included in evaluations. Broadbent (1992) recommends that senior managers also form part of these evaluations, not only users and information services managers, as cited by Badenoch *et al.* (1994: 33).

Badenoch *et al.* (1994: 34) refer to a study performed by Broadbent (1992) on assessing the opinions of middle managers towards information systems and they found that there were tensions about ownership and responsibility of information service functions, and in a related paper Broadbent and Sampson (1990) tried to identify organisational characteristics for firms wishing to gain a competitive advantage by using information and information technology (IT). As Badenoch *et al.* (1994: 34) reveals Broadbent found that successful companies invariably had a top management that valued their information systems, both from day-to-day operations and for strategic planning.

Badenoch *et al.* (1994: 35) cites a paper done by Clark and Augustine (1990) where they developed a methodology for evaluating information's worth in a manufacturing company, by analysing its accuracy, timeliness, reliability and relevance at three levels: operational, managerial and strategic. They used this framework to determine what would happen if the quality of information declined. Badenoch *et al.* (1994: 35) cite that

the decreasing accuracy had a major effect on profitability; that decreased relevance had an effect on efficiency, but otherwise a minor effect. Decreased timeliness affected all aspects of company performance; decreased reliability affected profitability greatly and efficiency was also reduced.

Further observations made by Clark and Augustine (Badenoch *et al.*, 1994: 35) was that when operational managers received low quality information this has the strongest negative effect on profitability, yet low quality information to managers outside of operations had less effect. As Badenoch *et al.* (*ibid.*) cites, "*Indeed, it was noted that high quality information supplied to senior levels cannot compensate for low quality information at an operational level. This is a significant finding.*"

In summary Badenoch *et al.* (1994: 66) makes the following statements,

- That information itself is not necessarily useful, it needs a filtering mechanism, and this is along the same lines as what Checkland and Howell (Hinton, 2006: 63) and Blumenthal (1969) have to say.
- Information that is not used is not information, thereby making it essential in finding out the views of those who use information so as to value it.
- How information is used and the outcome of that must be the ultimate way of judging the value of information.
- Information is the raw material for making decisions.

Tricker (1993: 1) also brings in the dimension of information providing power as is cited, "*There is nothing new in people's need for information. Moreover, information has always been a source of power. Information has always been fundamental to strategic decisions. What is new in modern organizations and societies is the potential to obtain information, and to control access to it.*"

Research is showing that information is data that has some meaning applied and this information will also provide a source of power. Bringing information into context of decision making, as cited by Tang, Ahmad, Ahmed and Lu (2004: 151), they express

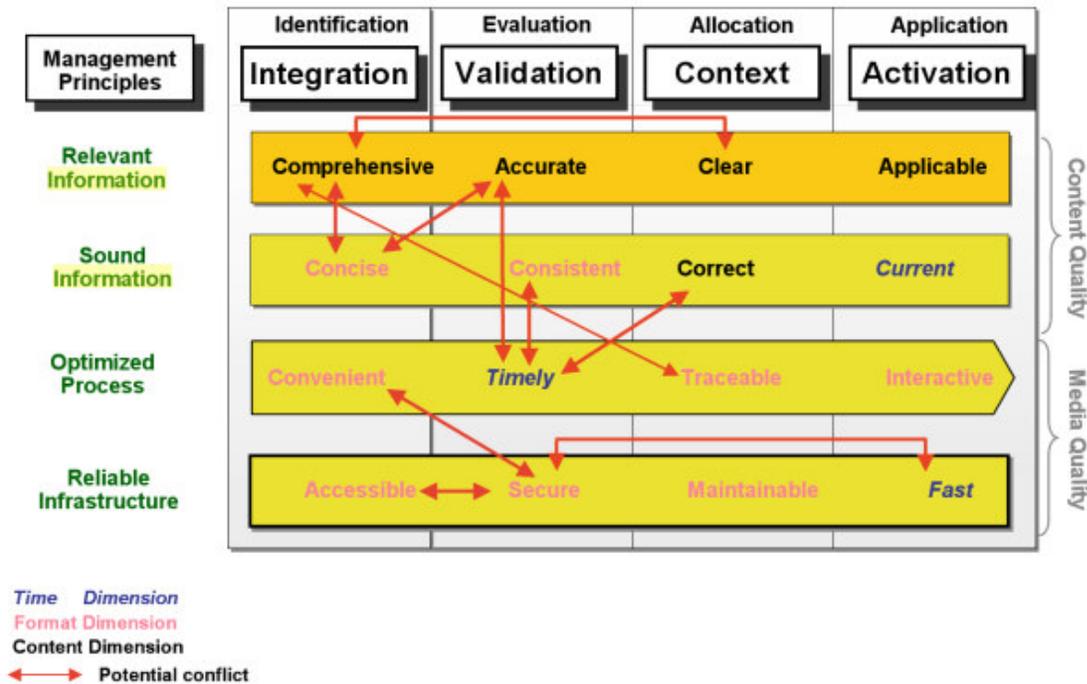
the opinion that effective decision making depends of the availability of appropriate information. Tang *et al.* (2004: 151) go on further to state that the availability of desired information to the required level of detail is necessary to make effective decisions. It is within this detail, as mentioned by Tang *et al.* (2004: 151) that the quality of information becomes relevant, as Eppler (2006: 1) asks, "*What makes information useful?*"

Eppler (2006: 1) goes on to answer his own question by stating that with the increasing quantity of information that is becoming available, "...*the quality of information becomes the crucial factor for the effectiveness of organizations and individuals.*" Eppler (2006) proposed a framework for information quality and goes on to describe that there are other frameworks proposed when it comes to quality criteria. Eppler (2006: 70) cites what Evans and Lindsay (1999) discuss as four distinguishing types of criteria, namely: judgmental criteria (well designed /aesthetic), product based criteria (free of errors), user based criteria (relevance) and manufacturing based criteria (timeless).

Eppler (*ibid.*) describes another classification done by Naumann and Rolker (2000) where they distinguish between subject-orientated criteria (relevance/understanding), object-orientated criteria (reliability) and process orientated criteria (response time/availability).

Eppler (2006: 66) proposes that his framework consists of four major elements as is shown in Figure 3.1 below. The first element is the framework's vertical structure which consists of four levels or views on information quality. As Eppler (2006: 66) cites, "...*information quality that categorize crucial information quality criteria according to their relation to the target community, the information product, the information process, and to its infrastructure.*"

Figure 3.1: Information quality framework.



Source: Eppler (2006; 68)

Eppler (*ibid.*) then describes the second element of his framework as the horizontal structure, which is then divided into four phases. Eppler (2006: 66) describes this as the phases that represent the life cycle of the information from the user's point of view. Eppler (2006: 66) describes the life cycle as, "... it is searched and found, evaluated, adapted to a new context, and applied." , as is shown in Figure 3.1.

Eppler (2006: 66) describes the third element as the quality criteria (as listed in Table 3.1) that are placed along the different phases according to their importance. As an example, the first quality criteria in the first vertical element (Relevant information) and horizontal element (Identification) would be the quality criteria 'Comprehensive' listed as 23 in table 3.1. How these criteria can be improved is what Eppler (2006: 66) defines as the last element in the framework, namely 'Management principles'. Eppler (2006) states that these principles help improve the quality of information in every phase.

These four levels of qualifiers which Eppler (2006: 66) refers to are, Relevant information; Sound information; Optimized process; Reliable infrastructure.

Eppler (2006: 67) describes them briefly as follows,

1. *Relevant information* relates to whether information is comprehensive, accurate and clear enough for the intended use, and whether it is easily applicable to the problem on hand.
2. *Sound information* contains criteria which describe whether it is concise or not, consistent or not, correct or not, and current or not.
3. *Optimized process* criteria which relates to the content management process by which information is created and distributed and whether that process is convenient, and whether it provides information in a timely, traceable and interactive manner.
4. *Reliable infrastructure* criteria which relates to the infrastructure on which the information is actually provided. Reliability in this context refers to a system's easy and continuous accessibility, security, its maintainability over time, at reasonable cost and high speed.

Eppler (2006: 67) states that these four levels are based on the Knowledge media theory of Beat Schmid, "...*that any design of knowledge media must begin with the analysis of the community of people who need to share knowledge, and must analyse their needs, activities, and work practices. Then, the services and information objects must be provided to and by this community and need to be analysed; and a process has to be designed in order to deliver these information services or information objectives. Only at this point can the infrastructure requirements and parameters be determined.*"

In brief Eppler's (2006: 68) model has two upper levels that are labelled '*content quality*' which are the 'relevance' and 'soundness' categories and they relate to actual information itself, thus dealing with the quality of information. The lower two levels cover the categories of 'process' and 'infrastructure' and are referred to as the media quality.

Eppler (2006: 68) states that the media quality is related to the management of information, "...*whether the delivery process and –infrastructure are of adequate quality which stresses the channel by which information is transported.*" Eppler (*ibid.*) therefore concludes that the end-user might see 'information' as a final product of both content and media quality.

Huang *et al.* (1999) (Eppler, 2006: 69) is cited as saying that information quality has conventionally been described as how accurate information is. However Huang *et al.* (1999) (Eppler, 2006: 69) states that information quality encompasses multiple dimensions and distinguishes between three approaches, intuitive, systematic and empirical.

- The *intuitive approach* where information quality is based on intuitive understanding or experience of individual or several individuals. The disadvantage being that it does not yield representative results.
- The *systematic approach* focuses on how information may become deficient during the information production process.
- The *empirical approach* where quality criteria are gathered by asking large sets of information consumers about their understanding of information quality in specific contexts. The disadvantage is that information consumers cannot always articulate the information quality criteria that are important to them.

Eppler (2006: 70) goes on to further describe in Table 3.1. a list of seventy most widely used information quality criteria as explicitly discussed and defined in information quality literature.

Table 3.1 Typical information quality criteria.

1. Comprehensiveness	27. Verifiability	48. Response time
2. Accuracy	28. Testability	49. Believability
3. Clarity	29. Provability	50. Availability
4. Applicability	30. Performance	51. Consistent Representation
5. Conciseness	31. Ethics/ ethical	52. Ability to represent null values
6. Consistency	32. Privacy	53. Semantic Consistency
7. Correctness	33. Helpfulness	54. Concise Representation
8. Currency	34. Neutrality	55. Obtainability
9. Convenience	35. Ease of Manipulation	56. Stimulating
10. Timeliness	36. Validity	57. Attribute granularity
11. Traceability	37. Relevance	58. Flexibility
12. Interactivity	38. Coherence	59. Reflexivity
13. Accessibility	39. Interpretability	60. Robustness
14. Security	40. Completeness	61. Equivalence of redundant or distributed data
15. Maintainability	41. Learnability	62. Concurrency of redundant or distributed data
16. Speed	42. Exclusivity	63. Nonduplication
17. Objectivity	43. Right Amount	64. Essentialness
18. Attributability	44. Existence of meta information	65. Rightness
19. Value-added	45. Appropriateness of meta information	66. Usability
20. Reputation (source)	46. Target group orientation	67. Cost
21. Ease-of-use	47. Reduction of complexity	68. Ordering
22. Precision		69. Browsing
23. Comprehensibility		70. Error rate
24. Trustworthiness (source)		
25. Reliability		
26. Price		

Source: Eppler (2006: 71)

Eppler (2006: 71) goes on to state that this extensive list can be shortened as it contains various inconsistencies and redundancies in the real-life context.

In summary Eppler (2006: 81) states that for information to be of value to information producers, administrators, and consumers, information must be provided at the right time, with relevant and sound content, in the right format, and at reasonable costs.

Lubbe (2004: 1) notes that what information managers use for decision making does not always state how accurate and up to date it is, and that for a large number of organisations the efficient use of up-to-date information is a key factor to success in a competitive market. Lubbe's (2004) article deals with searching for information that is used in decision making and related areas such as how managers can determine if

information retrieved is of acceptable quality. Lubbe (2004: 2) also considers the cost of acquiring information such as time and effort required to obtain information, this can include such as telephone expenses etc. Lubbe (2006: 3) also considers 'opportunity cost', which Lubbe (2004) defines as the cost of missed opportunities or losses suffered because the relevant information was not available to the right person at the right time.

Pack (1999) as cited by Lubbe (2004: 3) states that ensuring that information is trustworthy will incur costs for the organisation. Lubbe (2004: 3) also states in his article that Tillman (2003) supports this statement by noting that it would be a costly exercise to ensure that information is of high quality and that it meets stringent criteria.

Lubbe (*ibid.*) also goes on to quote Lee, Lee and Yoo (2002) who argue that extended criteria such as reliability, empathy, assurance, tangibility and responsiveness of information affect the decision making process and that these should be measured before the actual decision is made. Lubbe (2004: 3) states that decisions should therefore only be made where information has been proven to be reliable and responsive.

Lubbe (2004:5) describes what Buckland (1991) argues that information technology can increase the specificity of the information- especially the time factor. Choudhury and Sampler (1993) are cited by Lubbe (2004) as saying that information is time-specific if it must be captured at a specific point in time, otherwise it becomes less useful. These authors similarly to Lubbe (2004: 7) note that if it is time specific its use will decrease in value unless used very soon after it becomes available.

Lubbe (2004: 7) argues that decision making can benefit even more by taking cognizance of the qualitative properties of information. Marshall and De le Harpe (2009) also cite that making decisions in a business intelligence environment can become extremely challenging and sometimes even impossible if the data on which decisions are based are of poor quality. Marshall *et al.* (2009) go on further to say that it is only possible to utilize data effectively when it is accurate, up-to-date, complete and available when needed.

Marshall *et al.* (2009: 3) state that the widely and common accepted definition of information quality in existing research literature is as follows: “...*information that is ‘fit for use’ and satisfies the purpose for which it is intended.*”

Marshall *et al.* (2009: 3) goes on to quote Huang, Lee and Wang (1999) as saying that poor quality of production data reside in organisational databases and they can create false perceptions that can impact on decision makers’ ability to obtain insight into the business and make accurate and effective business decisions.

Marshall *et al.* (2009: 3) in their article also note that Strong *et al.* (1997), Lui and Chi (2002) and Helfert, Zellner and Sousa (2002) have established a framework that provides a starting point for assessing information quality criteria.

Heidmann (2008) cites Strong *et al.* (1997) who conducted a two stage survey to develop categories for organizing information quality dimensions. The four categories of data quality dimensions are outlined following their qualitative investigation into three companies that introduced data quality projects, namely:

- *“Intrinsic data quality (accuracy, objectivity, believe ability and reputation): Where discrepancies across disparate sources of data exist, believability concerns are raised regarding credibility and accuracy of underlying data.*
- *Accessibility data quality: Human and technical aspects such as lack of certain skills and expertise, as well as insufficient computing resources, can prevent access to information that is stored in central databases or shared repositories. Also it takes time to acquire these resources, which may result in required information not being available when needed.*
- *Contextual data quality (relevancy, timeliness, completeness and amount of data): Large data volumes can affect availability of information owing to the time it takes to process.*
- *Representation data quality (ease of understanding a consistent representation): Challenges are experienced in summarizing, integrating and analysing*

inconsistently represented data which makes information inaccessible for use owing to the minimum amount of value it will have for a consumer's decision-making process."

These four categories are also described by Marshall *et al.* (2009: 3) as they form part of the research done by them.

Madapusi (2008: 2) comments that in typical Enterprise Resource Planning systems (ERP) not much attention is paid to information quality and decision quality. ERP information quality can be measured using Wang and Strong's (1996) dimensional 'fitness for use' approach as cited by Madapusi (2008: 2).

In reflecting on Strong *et et al.* (1997) (Marshall *et al.*, 2009: 3) categories, in respect of the PFK (2010) research situation , they make very valid points about the ability to source data from the same source of information as was noted during 'Problem in context'. This also links to the skill of the individuals that source this information as their abilities to extract data from sources will have an impact on getting the data in time for it to be useful in the decision making process ,as Strong *et al.* (1997) noted (Marshall *et al.*, 2009: 3).

The Technology evaluation centre (2008: 3) in an article on Operations and decision making states that Operations needs timely and accurate data to guide decision making and that this data must come from a unified source, because of the challenges of remaining competitive and profitable in a dynamic market place. PFK (2010) is not immune to these pressures because of the nature of the business it faces immense pressure from eastern countries like, Taiwan, Korea and China who all remain very competitive in Electronics manufacturing.

The Technology evaluation centre (2008: 1) warns that by not having an accurate and unified source of data, limits the operations function in several key ways, namely

- Ability to track business performance
- Ability to respond in a timely and profitable manner to market conditions

- Ability to quickly and accurately track costs.

The Technology evaluation centre (2008: 2) states that they believe the best way to address these problems is for operations to obtain a system that places a complete range of real-time data at the fingertips of operations to fulfil its mission. Systems such as Enterprise Resource Planning Systems (ERP).

Marshall *et al.* (2009: 4) bring further context to information quality by citing a research article done by Lui and Chi (2002) on the quality of data as it goes through its lifecycle.

Lui and Chi (2002) are cited by Marshall *et al.* (2009: 4) as saying that reviewing the quality of data in relation to where it is in the life cycle is important as at each stage of transformation different types of quality issues can affect the usefulness of the data.

Marshall *et al.* (2009: 4) go further to summarize what Lui and Chi (2002) classified as the stages of data quality and concerns namely;

- *Collection quality* which relates to the process of obtaining data and includes characteristics such as, bias and ambiguity during observation, poor accuracy of data, reliability of the data collector and the completeness of data in terms of its use. This correlates with what Eppler (2006:66) was defining in his framework of analysing data quality in his third dimension.
- *Organisation quality* which relates to how the data is stored, timeliness of data retrieval and the ease of being able to navigate the information. In terms of PFK (2010) this would refer to the use of ERP data and would need to form part of the survey questionnaire to establish context.
- *Presentation quality* where data needs to be presented in a format that allows the data to be clear and easy to interpret and 'reflect neutrality'.
- *Application quality* which relates to all of the characteristics listed above that all impact on the effective use of information. This correlates with Eppler's (2006:

68) framework where he classifies 'media quality' as forming part of the management principles of the 'optimized process' and 'reliable infrastructure'.

Marshall *et al.*'s (2009) article presents research into a retail organization using the criteria presented by Strong *et al.* (1997) and Lui and Chi (2002) where they identified quality impacts. Marshall *et al.*'s (2009) findings in this regard were: "*Accuracy, consistency, understand ability and availability are key factors that affect the quality of information and create barriers during the utilization process. This can have severe implications for an organisation when outcomes of certain decisions affect profits, expenses, reputation, partner or supplier relationships and customer loyalty.*"

In summary Feeney and Grieves (1994), Hinton (2006), Tang *et al.* (2004), Eppler (2006), Lubbe (2004), Marshall *et al.* (2009) and Heidmann (2008), all agree on very similar definitions of information and quality framework criteria required to make effective decisions.

In a more recent journal article, authored by Corrigan and Sprehe (2010) it is argued that information needs to be considered an asset as in their article on U.S. Air force record management. This thinking could also be applied to PFK (2010) electronics in that information is an asset to any organization.

Although the Corrigan *et al.* (2010) article is based on a study, very specifically on data management and retention of records, they do make very relevant observations regarding information management principles that will be of benefit to PFK (2010) research problem. They make the following observations that come out of the Air Force policy directive 33-3 (Corrigan, 2010: 27), "

1. *Information is an asset so long as it has a positive value to the enterprise.*
2. *Information is a time related asset.*
3. *The value of information depends on the ability of the enterprise to discover, access, understand, and consume the information."*

These three criteria for information to qualify as an asset, support what Eppler (2006: 70) cited on the four criteria that Evans and Lindsay (1999) defined, as well as supporting Eppler's (2006: 68) own framework, which is essentially defining its value as an asset based on criteria modelled in his framework.

For these requirements to be an information asset, as stipulated by the US Air force directive 33-3 (Corrigan, 2010: 27) also reinforces what Lubbe (2004:1) had to say on the information becoming a key success factor in a competitive market.

In summary Madapusi (2008) is cited as quoting Davenport (1998) and Sadagopan (1999) where they state that, "*ERP systems seamlessly integrate data from different functional areas to provide information for decision making. Different decision-makers directly tap into the ERP database to access information for carrying out different organizational tasks. The use of the same information by different decision-makers has increased the need to ensure that high quality ERP information is available for effective decision-making.*" This puts into context information, its value and quality in decision making and therefore its impact on decision making within the PFK (2010) environment.

3.3. Decision making theme.

Mezias and Starbuck (1996: 83) state that decision makers should be sceptical about data affecting their decisions. They go further to state that the apparent facts surrounding decisions are actually distributions of possible facts, and these distributions have wide variances. To this end Mezias and Starbuck (1996: 83) cite a proposition made by Cyert and March (1963) that organisations pursue 'uncertainty avoidance'. Cyert and March (1963), (Mezias and Starbuck, 1996: 83), said that organisations avoid having to anticipate accurately by reacting quickly and by negotiating with and controlling their environments. As Mezias and Starbuck (1996: 83) note, few subsequent studies have observed what organizations do to avoid uncertainty.

Mezias and Starbuck (1996: 83) cite, "*In the real world decision, prevalent reactions to unreliable data include seeking more data, collapsing probability distributions into certainties, reverting to ideologies, acting incrementally and playing to the audience.*"

Feldman and March (1981) are mentioned by Mezias and Starbuck (1996: 83), and it is pointed out that even though organisations gather more information than they use, they also routinely ask for more information. People act as if they can reduce or eliminate uncertainty in data by collecting more data. The data people tend to seek is data that will reinforce their current perceptions, and seeing additional data tends to give people more confidence in their expectations and perceptions even though the additional data does not make it any more accurate.

Mezias and Starbuck (1996: 88) go on to state that the most interesting challenge is to design organisations and decision processes that act effectively despite inaccurate and unreliable data.

Miller (2008: 139) quotes Nutt (1999) as having concluded that half of the decisions made by organisations fail because of poor use of decision making tactics by managers and problems with communication. Chris Gibbons (2011) in an article in a recent book published by Bain and Company Inc. cites Paul Rogers as saying that, "*Our global research programme, which is based on about 1000 large companies globally, shows a huge correlation between effective decisions and two desirable outcomes. Companies that do better at decisions make more money and have happier people.*"

In the researchers opinion this would seem to be the ideal for any organisation, making money and having happy people which are two of an organisation's biggest assets.

Blenko, Manking and Rogers (2010) in their book on research into decision making processes, state that the ultimate challenge for any organisation is to create an environment where best practices naturally happen and the whole organizational system supports people in making and executing good decisions quickly. Blenko *et al.* (2010: 96) go on further to explain how complex organisations are so they divide the elements into hard and soft categories, in order to understand how to get all elements working together to achieve good decisions.

Blenko *et al.* (2010: 96) describe the hard elements as the elements such as those that can be written down, like an organisation chart. They go on further to say that

organisations operate on processes, information flows etc. and no company can deliver its purpose if its roles aren't clearly defined, if its processes do not run smoothly and most importantly if it does not have good information and incentives. Blenko *et al.* (2010: 97) refer to these as the plumbing and wiring of an organisation, they have to work in order for the organisation to function.

Blenko *et al.* (2010: 97) go on to describe the soft elements as the human factors, describing this as the organisations 'animating spirit'. Blenko *et al.* (2010: 97) cite that people are not just motivated by money, but they have ambitions and passion, strengths and shortcomings, so organisations do not succeed on the mechanics only, "*...but also on the attributes that energize and inspire people – the power of their principles, the strength of their cultures, the alignment and behaviour of their leaders.*" As Blenko *et al.* (2010: 97) state, "*If a company wants to be a top performer, its plumbing and wiring must function properly. But its spirit must soar.*"

The core of what Blenko *et al.* (2010: 97) and their team state in their findings, is that the headings of what describes hard and soft elements are familiar, but the difference in their theory is that they view them all from a unifying perspective- 'decisions'. Table 3.2. as cited by Blenko *et al.* (2010: 98) describe the difference between the traditional approach and the decision centred approach.

Table 3.2. Differences between traditional and decision centered approach.

	Traditional approach	Decision-centered approach
Hard	Is our structure aligned with our strategy?	Does our structure support the decisions most critical to creating value?
	Who should report to whom?	What are the specific roles and accountabilities for our critical decisions?
	Are our core business processes effective and efficient?	Are our processes geared to produce effective, timely decisions and action?
	Do our information systems support our business objectives?	Do the people in key decision roles have the information they need when and how they need it?
	Is our compensation competitive with peers?	Do our performance objectives and incentives focus people on making the right decisions for the business?
Soft	Do we have a clear and compelling mission and vision?	Do people throughout our organization have the context they need to make and execute the decisions they face?
	Is our management style sufficiently inclusive?	Are our people clear on our preferred decision style (directive, participative, democratic, consensus)?
	Are we winning the war for talent?	Do we put our best people in the jobs where they can have the biggest impact on decisions?
	Do we have an effective leadership team?	Do our leaders at all levels consistently demonstrate effective decision behaviors?
	Do we have a high-performance (sometimes "customer-centric") culture?	Does our culture reinforce prompt, effective decision making and action throughout the organization?

Source: Blenko et al. (2010: 98).

Blenko et al. (2010: 107) state that the alignment is essential; however you cannot have good, fast decisions and execution without information in the right place at the right time. This is a recurring theme, having information at the right time as was cited by Eppler (2006) and Corrigan (2010) amongst a few.

Blenko et al. (2010: 107) go on further to state that the key to gathering the right information is to think exactly what is required for critical decisions and to figure out how to make it available in a systematic way. The researcher will attempt to answer this question as part of the interview process.

Blenko et al. (2010: 108) also cite that the decision view also helps prioritise investments in information systems and analytics. Blenko et al. (2010: 108) cites the following, "*Today's information technology- from massive enterprise resource planning*

(ERP) systems and executive dashboards to blogs and wikis- can provide endless amounts of data. But the real issues are what information people need to make and execute critical decisions.”

Sales and Operational Planning is defined by Wallace and Kremzar (2001: 165) as management’s handle on the business and that it forms an essential part of ERP and its mission essentially is to ‘balance demand and supply.’

According to Wallace and Kremzar (2001: 167) research they found that companies can ship better, ship more quickly and do it with less inventory using ERP systems. SOP’s also links the business plan to the Master schedule according to Wallace and Kremzar (2001: 167)., They go on further to say:, *“Many of the decisions made in S&OP affect the business plan- the financial plan for the current year, and top management ‘owns’ that business plan.”*

Wallace and Kremzar (2001: 5) best describe Enterprise Resource Planning as making it possible for profound improvements to be made in the way that manufacturing companies are managed. Wallace *et al.* (2001: 5) describe ERP as: *“An enterprise-wide set of management tools that balances demand and supply, containing the ability to link customers and suppliers into a complete supply chain, employing proven business processes for decision making and providing high degree of cross functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development, and human resources, thereby enabling people to run their business with high levels of customer service and productivity....”*

Syscom (2009) in their article on MES vs. ERP cite that linking the shop-floor to the top-floor is becoming increasingly recognized as crucial to securing success in the manufacturing industry. Syscom (2009: 1) define MES as Manufacturing Execution Systems that use current and accurate data that reports on plant activities as they occur. However Syscom (2009: 1) go further to say that, *“In order to link plant floor events in real-time with business events, ERP or similar software might be a better option.”* Syscom (2009: 1) summarizes that a good ERP system could,

- connect manufacturing operations with the entire organization

- give an enterprise wide view and reporting to allow for better, more informed decision making
- provide an effective means of translating strategic business goals to real-time planning and control.

Syscom (2009: 2) consolidates the idea of running MES system to link shop floor data with the ERP system to get a more comprehensive real time view of production whilst still having the benefits of the ERP system which increases efficiency while gaining business insights through best business practice, securing competitive advantage and maximizing profits.

Orian (2011: 1) writes that companies such as Omnitrol networks believe that manufacturers will start moving their IT priorities from the back office towards the factory floor, for real time manufacturing intelligence, and that doing so will create a higher return in business value. Orian (2011: 1) goes further to interpret 'manufacturing intelligence' as defining to mean the automatic data capture from the shop floor, "*which in turn 1) delivers real time visibility; 2) provides analytics on key performance indicators (KPIs) to optimize business performance; and 3) enables a real time collaborative enterprise.*"

Orian (2011: 1) believes that this will enable management by exception as he states that executives bear overall responsibility for the performance of the organization, but due to information lags, recovery times and over standardization of reports etc. it is complicating enquiries into the exceptions. This, as Orian (2011:1) describes it, leads to huge amounts of man hours going into looking for information and answers or that suboptimal decisions get made on old and inaccurate information, that lead to problems that could have been avoided.

Ballot (1986: 3) states that production and operations management makes extensive use of quantitative, analytical decision making models and techniques. Miller (2006: 169) cites that decision making models are moving away from the rational models toward those based on intuition and other less logical premises.

Ballot (1986: 3) cites that decision making models can be classified in several ways, and that one of the classifications frequently used is where classification is done based on the nature of the solution they generate. Ballot (*ibid.*) goes on to describe 'optimizing models' as models that yield the 'best' answer to the problem. Ballot (1986: 3) uses an example that, if trying to minimize costs, the answer would be a cost minimizing solution and no other solution would yield a lower cost, thus making it 'optimum'.

Miller (2006: 169) cites that in classical theories of organizational behaviour, decision making was entirely a rational and logical process. Miller (2006: 169) describes this as a process where organizational members would notice a problem that needed a decision made. After carefully defining the problem, Miller (2006: 169) writes that the decision makers would then search for all the relevant information that might bear upon the problem at hand. Miller (2006:170) goes further to describe the process; the decision makers develop a set of decision options and evaluate them according to carefully developed criteria for decision effectiveness. The decision making process as described by Miller (2006: 170), then concluded when an optimal decision was identified, so that decision implementation could begin.

Miller (2006: 170) notes that Nutt (1984) described this type of decision making model based on rational and logic method as being the 'normative' model which included five stages: formulation, concept development, detailing, evaluation, and implementation.

Miller (2006: 170) cites that March and Simon (1958) characterized this traditional approach as the 'optimizing' model in which decision makers attempted to find the single best solution to a problem, which is how Ballot (1986: 3) also referred to it .

Ballot (1986: 3) then goes onto describe models that yield a 'satisfactory' solution based on a rather restrictive set of alternatives as a 'satisficing' model. Miller (2006: 170) supports Ballot's (1986) description by going onto explain that March and Simon (1958) believed that it was more realistic to look at organizational decision making as a 'satisficing' process in which the search was not for a single optimal solution, but for a solution that will work well enough for dealing with the situation.

As Miller (2006: 170) comments that these rational and logical processes sound like the ideal way to make decisions, many scholars recognized that these rational models were not a good representation of how organizational decisions were actually done.

Miller (2006: 170) explains by citing Pugh and Hickson (1989) explaining that: *“Most decisions are concerned not with searching for the sharpest needle in the haystack, but for searching for a needle sharp enough to sew with. Thus, administrators who ‘satisfice’ can make decisions without a search for all the possible alternatives and can use relatively simple rules of thumb. In business terms, they do not look for ‘maximum profit’ but ‘adequate profit’; not ‘optimum price’ but ‘fair price’. This makes their world much simpler.”*

Ballot (1986: 3) also states that these models are sometimes called ‘descriptive’ models, as it tries to describe how ‘real’ administrators and managers made decisions. As Miller (2006: 171) notes that Simon and March (1958) proposed that organizational decision makers used ‘satisficing’ strategies because it was not possible to come to an ideal rational solution. Miller (2006: 169) talks about the movement away from rational models to models based on intuition and other less logical premises.

Miller (2006: 171) goes on further to state that March and Simon (1958) say that decision makers are characterized by ‘bounded rationality’, meaning that decision makers are attempting to make logical decisions, *“...but they are limited cognitively (e.g., humans are not always perfectly logical) and by the practical aspects of life (e.g., limits in time and resources).”* So as Miller (2006; 171) explains, March and Simon are proposing that decision makers still use logic but they do so under personal and organizational constraints.

Miller (2006: 172) talks about more recent theoretical work done by March and Simon where they moved on to propose models even further removed from optimizing models than satisficing models. Simon (1987) as is cited by Miller (2006: 172) proposed that a great deal of decision making can be attributed to ‘intuitive processes’ of managers.

Miller (*ibid*) goes on further to explain that Simon (1987) reverts back to work done by Barnard (1938) who suggested that there was a distinction between logical and non-logical management processes. Simon stated that Barnard argued that decision makers were often forced to make quick decisions without the opportunity for information search or debate, stating that managers often then made decisions without the conscious knowledge of how these decisions were made.

Miller (2006: 172) cites Barnard (1938: 302) as describing his thinking on the matter as follows, "*The sources of these non-logical processes lie in physiological conditions or factors, or in the physical and social environment, mostly impressed upon us unconsciously or without conscious effort on our part. They also consist of facts, patterns, concepts, techniques, abstractions, and generally what we call knowledge or beliefs, which are impressed upon our minds more or less by conscious effort and study.*"

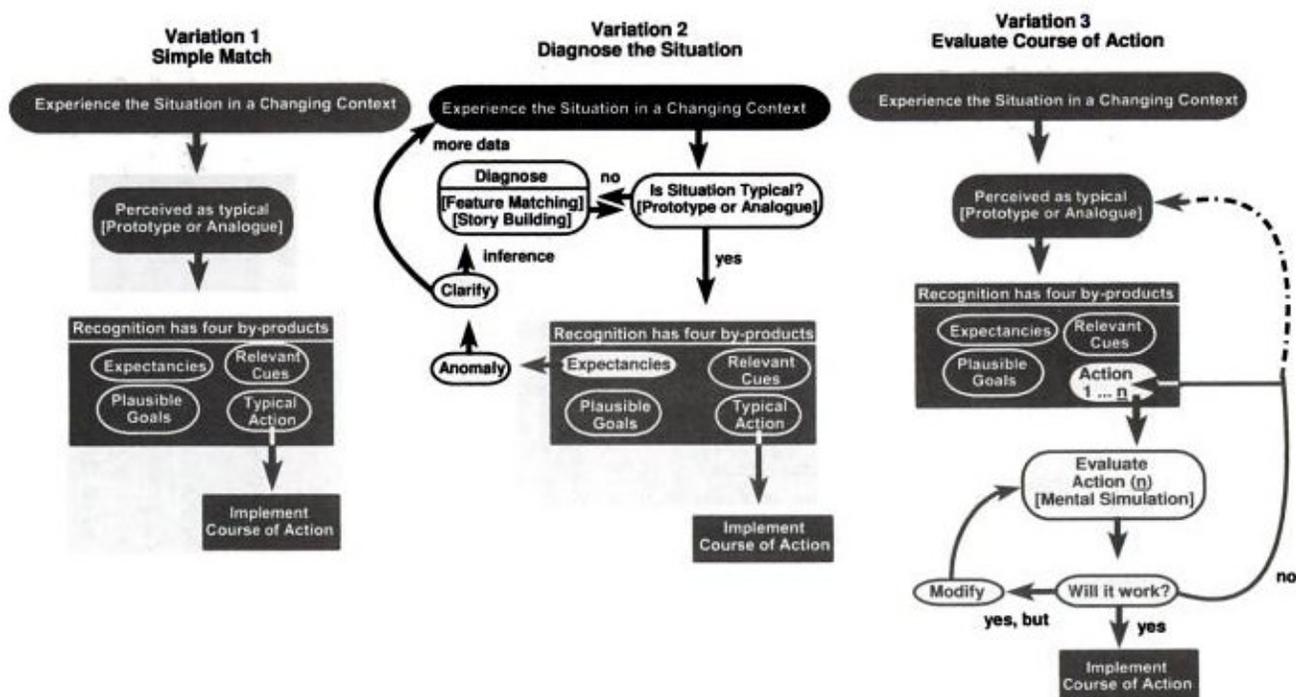
The researcher would put this to the tacit knowledge gained through experience and learning. Miller (2006: 172) goes further to state that Simon (1987) points out that although intuitive decision making is not 'logical' it is not 'illogical' either. Miller (2006: 172) defines this as an 'analogical' kind of decision making, in other words a manager will base a decision on what worked in similar situation before. Essentially as is cited by Miller (2006: 172) intuitive decision making is dependent on the decision maker accessing relevant 'chunks' of information and putting it to use.

Decision Innovation Inc. (2011) talks about intuition as describing something that is known, perceived, understood or believed by instinct, feelings or nature without actual evidence. Further to this Decision Innovation Inc. (2011: 1) states that intuition plays a significant role in decisions made and that intuition can be a great source of error, for example not giving sufficient consideration to alternatives as intuition generally relies on pattern recognition and will point to solutions that worked well before with the current perceived pattern. However, there is no guarantee that the pattern that is perceived is the same. Decision Innovation Inc. (2011: 2) states that there are cognitive models that are evolving that are helping in the understanding of intuitive decision making, making

reference to work done by Gary Klein and others on The Recognition Primed Decision (RPD) model.

Klein (1999) describes the recognition primed decision (RPD) model as fusing two processes: the way decision makers size up the situation and then recognize the course of action that will make sense, and the way they evaluate the course of action by imagining it. As is illustrated in Figure 3.2. below in variation 1 as is cited by Klein (1999: 24), decision makers will recognize the situation as typical and familiar, eg. A fireman will recognize a typical garage fire, and then proceed to take action. Klein (1999: 24) goes on to describe using the fireman example that they would understand what type of goals make sense, set the priorities; which cues are important so as not to overload on information; what to expect next so that they can prepare themselves and notice surprises, and then respond with the typical ways in the given situation. Klein (1999: 26) explains that many decision makers do not start with the goals or expectancies and then figure out the nature of the situation.

Figure 3.2.: RPD model



Source: Klein (1999: 25).

Klein (1999: 26) cites further that the model has two additional variations which handle more complex situations, whereas in variation 2 occurs when the decision maker has to devote more attention to diagnosing the situation since the information may not match a typical case or experience or there might be more than one case or experience that is recalled, thereby requiring the decision maker to find more information in order to diagnose. Klein (1999: 26) describes variation 3 as how decision makers evaluate single options by imagining how the course of action will play out, and if the decision maker imagines or anticipates difficulties then the course of action might require adjusting or be rejected in favour of another option.

Klein (1999: 26) does state that this model contains elements of other models, but in its integrated form has never been proposed.

Miller (2006: 172) cites that a recent study on intuitive decision making done by Burke and Miller, (1999) supports many of Simon's (1987) ideas, stating that the study showed that when managers were asked about whether they used intuition in decision making, only 10% responded as saying they used intuition 'seldom' or 'rarely'.

Miller (2006: 172) proposes that another alternative to rational decision making was proposed by March and his colleagues (1972) in their Garbage Can model of decision making, proposing that the decision making process is a process in which problems, solutions, participants, and choices are all dumped together in a relatively independent fashion. Miller (2006: 173) then explains that a decision is made when, "*a suitable collection of problems, solutions, participants, and choices coincide (Pugh & Hickson, 1989: 145).*"

Miller (2006: 173) provides an example of this by describing that a manager might have a pet plan for a new billing procedure that just so happens to coincide with a colleague's need to revamp accounts receivable, the decision that arises in this situation was then not of logical search and solution but rather a happy coincidence.

3.4 Summary

The theories as described by the various authors suggest that information and decision making are very complex topics which are closely related and interdependent.

Information has been defined by different theorist, all ultimately agreeing that there are many dimensions that make information valuable to individuals and processes. Decision making has many different theorists talking about rational and intuitive methods of making decisions and it will be up to the research to determine what and how PFK understands and values information. Furthermore, how, based on what the theorists have to say, decisions are made in the PFK (2010) environment. The theories discussed also touch on the influence of strategic planning and communication within the research done on main themes of information and decision making.

Chapter 4: Research design.

4.1. Research design concepts.

For the purpose of collecting the necessary data and information the researcher will follow the 'Descriptive research' type of business strategy. This type of strategy is described as is cited in Coldwell and Herbst (2004: 9) as, "*The major purpose of descriptive research, as the term implies, is to describe the characteristics of a population or a phenomenon (Zikmund, 2003). Descriptive studies aim at answering who, what, when and where questions. In this type of research, management already knows or understands the underlying relationships of the problem at hand.*"

Descriptive research is further clarified by AECT (2001) where they describe 'descriptive research' as not fitting neatly into the definition of either quantitative or qualitative research methodologies, instead utilising elements of both. AECT (2001) cites "*Descriptive research can be either quantitative or qualitative. Descriptive research*

involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection (Glass & Hopkins, 1984.)”

Campbell and Stanley,(1963) are cited by AECT (2001) as saying that some of the common data collection methods applied to questions within the realm of descriptive research include surveys, interviews, observations, and portfolios.

Taking a critical reflective view of the PFK (2010) research problem as is defined, further confirms that ‘Descriptive research’ is the strategy type that will be best used. . Furthermore, when reading what is cited by Coldwell and Herbst (2004: 9), *“It is clear that mere description of a situation may provide important information and that in many situations descriptive information is all that is needed to solve business problems, even though the answer to the question why? is not given or even attempted (Zikmund, 2003).”*, confirms that descriptive research methods are relevant for this study.

The next stage of research design is to employ a ‘Qualitative approach’ as it has the following advantages that would benefit the ‘Descriptive research approach’. The researcher has decided on this approach given the research problem in context of PFK electronics (Pty) Ltd. (2010) and this is supported as is cited in Coldwell and Herbst (2004: 16), *“It should be borne in mind that the methods most suitable for a particular research project depend on the research problem and the purpose of the research (Ghauri et al., 1999).”*

Advantages of the Qualitative approach are that they do not consider the pure numerical analysis of information or situations but consider the actual people aspect and value of information based on opinion and feelings. From a business perspective it provides the depth required to make decisions that provide a holistic approach that makes managers make better decisions. For example just having the performance figures of a production department does not tell you how well the people and process are managed and any potential pitfalls or conflicts there might be lurking. Qualitative

information used in conjunction with the quantitative information allows much better informed decisions to be made.

As cited in Coldwell and Herbst (2004: 15), *“Qualitative research allows in depth analysis of problems, opportunities and situations in the business environment and it has the advantage in some instances of being less costly than quantitative research techniques for gathering data.”* Another advantage of the qualitative approach is in being able to measure factors that cannot be easily measured by using numbers or getting numerical data, as described in Coldwell and Herbst (2004: 15), *“If it proves difficult to describe something in numerical terms, we resort to qualitative techniques.”*

Therefore the use of a descriptive research strategy using qualitative methodology in this study is appropriate as the researcher aims to gather primary data that will give proper description and analysis of the situation within PFK Electronics (Pty) Ltd. (2010), through a questionnaire survey and interviews.

4.2. Population and Sampling.

4.2.1 Population: A sample as defined by ‘Webster (1985)’ in Coldwell and Herbst (2004: 74) is, *“A sample provides a finite part of a statistical population whose properties are studied to gain information on the whole. When dealing with people, a sample can be defined as a set of respondents (people) selected from a larger population for the purpose of the survey.”* This is exactly the likely scenario that the researcher will experience in the research survey of PFK Electronics (Pty) Ltd. (2010).

Considering that it has been established that it would be primary data that would be used and using triangulation to support the research problem it would be appropriate to collect information only about some members of the marketing and operations group that will represent the whole. As cited in Coldwell and Herbst (2004: 73), *“Sample: Obtained by collecting information only about some members of the population.”*

The population referred to by Coldwell and Herbst (2004: 73) for this research , would be Operations and Sales personnel who are directly involved in the Sales and Operational planning processes at PFK Electronics (Pty) Ltd. (2010) as depicted in Table 4.1 below.

Table 4.1. Population sample demographic and interaction table.

Department	Function	Survey	Interview
Commercial Sales	Commercial sales manager	✓	✓
Operations	Planning manager	✓	✓
Operations	Procurement manager	✓	✓
Operations	Production manager	✓	✓
Operations	Procurement Buyer	✓	✗
Operations	Jnr production manager	✓	✗
Operations	Planner	✓	✗
Operations	Admin clerk	✓	✗
Operations	Factory floor Team leader	✓	✗
Operations	Factory floor Team leader	✓	✗
Operations	Factory floor Team leader	✓	✗
Operations	Factory floor Team leader	✓	✗
Finance	Cost accountant	✓	✗

In summary a sample of the population (Total population: 40) in sales and operational management was used to establish what information operations need to make effective decisions through survey as they will represent the whole population. The sample represents senior management, middle management and the factory floor. The sample size is a considerable portion of the population from a management perspective as the Sales and Operational management team consists of a few members who are all included; and a sample of population comes off the production floor where a large population exists, and thus the use of inferential statistics would be used to determine that populations characteristics as is cited in Coldwell and Herbst (2004: 74), *“To draw conclusions from samples, we must use inferential statistics which enables us to determine a population’s characteristics by directly observing an enumeration (a census) of the population for many reasons.”* We can infer that if some production line

team leaders (sample) are using certain information that the rest of production team leaders (whole population) would probably also do the same.

4.2.2. Representative sample: This has to be a sample that can adequately reflect the properties of the whole population. Not getting this right will provide the opportunity for any research conclusions to be dismissed or argued which would have resulted in a waste of time and money. It must be defined correctly upfront to allow for sampling to be effective.

In the case of the research that is intended through the questionnaire survey and interviews using the sample population as described in Table 4.1, the sample population will represent the total PFK population.

4.2.3 Sample Size: The sample size as cited in Coldwell and Herbst (2004: 82) should only be decided once you know whether the population you are studying is finite or infinite and you have determined your sampling frame. If this has not been established the likely hood is that the sample size would not be sufficient to provide data integrity or authenticity and therefore putting the research and its conclusions at risk.

To ensure authenticity and data integrity sample size should be based on general principle as described by Coldwell and Herbst (2004: 82), “

- *Whether population is finite or infinite;*
- *The precision of the estimates one wishes to achieve;*
- *The confidence one needs to have in the findings being accurate/correct;*
- *The number of variables that have to be examined simultaneously;*
- *How heterogeneous the population sample is.”*

The sample size would be a considerable portion of the population from a management perspective as the Sales and Operational management team consist of a few members which will all be included. A sample of the total operational population would come from

the production floor where a large population exists, and thus the use of inferential statistics would be used to determine that populations characteristics as is cited in Coldwell and Herbst (2004: 74).

The researcher has decided to use qualitative research approach to which there are no prescribed rules as to sample size, as described in Coldwell and Herbst (2004: 82), *“It will depend on what you want to know, the purpose of the enquiry, what will be useful, what will have credibility and what can be done with available time and resources...as far as possible, representative of the population from which they are drawn.”*

However in the case of the PFK (2010) research project the population is finite and therefore the sample size as cited by Coldwell and Herbst (2004: 82) is not calculated but rather decided in relation to representing the population. The sample used at PFK (2010) works out to be 100% of operations management and administration population and 30% of factory floor representation.

4.3. Data collection methods.

In order for the researcher to gather relevant data, the predominate method of primary data collection is through instruments such as the questionnaire survey method using a formulated questionnaire and then followed up with interviews and secondary data collection, coming from minutes of meetings. The data collected will be subjected to analysis; therefore a descriptive and comparative approach using qualitative data will be used in analysing results. The results will have explanatory notes where required, and the results is to be presented in graphical and table format.

Primary data is the data that can be directly collected from a source through the use of a questionnaire; interviews; direct observation or data as collected by equipment. It is first hand current data that is collected by the researcher as would be the case in the PFK (2010) research study. The researcher has direct knowledge of the source. As cited by Cameron (2005: 377), *“Primary data can be tailored to your particular requirements”*, which secondary data does not allow.

In contrast Secondary data is data that has been collected by others and could be in the form of historical records, statistical data etc. Secondary data is typically used in support of primary data by showing historical trends or statistics as many governmental and survey companies tend to supply this data. In the research within PFK (2010) this secondary data will be Standard Operating procedures and meeting minutes.

As is cited earlier in the Research Objectives, Table 4.2 illustrates the type of primary data that will be sourced as well as the methodology employed to obtain this data.

The instruments used were, a 24 question survey, 20 Minute max interviews limited to 10 questions, and observations made with permission of senior managers and those being observed.

Table 4.2.: Data collection methods.

What?	How? Instruments
Information used in Sales and Operational planning (SOP's) Decisions.	Survey questionnaires.
How SOP's decisions are made.	Direct Interviews using set questions.
Supporting documents	Cross functional team and SOP's minutes of meetings.

Source: Adapted from 'Becoming a Practitioner researcher' (Lewis, 2001: 32).

4.4 Validity and Reliability.

4. 4.1 Reliability: If the sampling procedure and sample plan clearly define the sample and the sample size and how the data was sourced then it would be deemed reliable if someone else doing the same exercise would achieve similar results. As is cited by Lewis (2001: 37): *“Basically, reliability is whether you have measured or recorded something accurately, such that if another person repeated the exercise they would obtain the same result.”* It is therefore important in looking at this with a critical reflective

view that the data that is collected can be analysed and the similar conclusions drawn, using a reviewing process of a panel of selected staff as part of the analysis process. This would assist in PFK obtaining the most benefit from the data analysis process. Furthermore, to reinforce 'reliability of data' as is cited by Lewis (2001: 37), "*...if your evidence is not sufficient, authentic or valid it will not matter how reliable it is.*"

4. 4.2 Validity: Validity is whether the measure or observation actually represents what you think it does as is cited by Lewis (2001: 37). Did the research actually measure what was intended to be measured? If it did then the data integrity would be good and there would be no risk to conclusions made.

- Threats to validity: Poor execution of the data that was being collected resulting in the data that was to be measured not being measured.
- Improving validity: Making sure that the intended data that would validate the research is measured and this can be done by getting feedback from others on the data that is intended to be measured to ensure that it answers the question, "Is the research measuring what it is supposed to measure?" (Christ, 2009).

It is therefore essential that the evidence used to support the argument at PFK (2010) is acceptable and it should be testable and therefore it is essential that through the whole process of the research survey and data collection, that the evidence is tested, as is cited in Lewis (2001: 36), "*The tests that can be applied to help you to decide whether evidence is acceptable are:*

- *Is it sufficient?*
- *Is it authentic?*
- *Is it valid?*
- *Is it current? "*

4.5. Summary.

The researcher followed a descriptive research approach using qualitative methods. The sample population was out of the sales and operational environments at PFK Electronics (Pty) Ltd. (2010) with senior management, middle management and the factory floor represented. The sample size is defined as 100% of management and administration within sales and operations as well as 30% of factory floor population. Data was collected through a survey questionnaire, a interview process as well as various supporting documentation such as minutes etc.

The reliability of the work will be tested in the ability of whether someone else is able to achieve the same results as the researcher and proven valid if the research can be tested as described in 'becoming a practitioner researcher' Open University 92001: 36) and pass.