Chapter 5: Results and Discussion

5.1 Introduction.

The aim in this chapter is to present the results established through the questionnaire survey and subsequent interview process so that the results can be interpreted in terms of the theory and observations made by researcher. As it was documented in chapter 4, the sample population has representation from senior management (decision makers), middle management and the factory floor. The objectives of this research are as follows,

- To investigate 'what' information sales and operations managers need in order to make effective decisions that will have an impact on them meeting the strategic performance objectives. The data/information is specifically linked to Sales and Operational planning objectives.

- To evaluate 'how' real time shop floor information can improve the decision making process in Operations in meeting their 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.

5.2. Population and Sample

As was described in chapter 4, the following table describes the demographics of the sample population as depicted in Table 5.1 below.

Table 5.1: Sample population demographic makeup

Department	Function	Management Level
Sales	Commercial sales manager	Senior Manager
Operations	Planning manager	Senior Manager
Operations	Procurement manager	Senior Manager
Operations	Production manager	Senior Manager
Operations	Procurement Buyer	Middle Management
Operations	Jnr. Production manager	Middle Management
Operations	Planner	Middle Management
Operations	Admin clerk	Middle Management
Finance	Cost accountant	Middle Management
Operations	Team leader	Factory floor
Operations	Team leader	Factory floor
Operations	Team leader	Factory floor - Union member.
Operations	Team leader	Factory floor - Union member.

Thus the demographics of the population / sample can be summarised into three groups, senior managers; middle managers and factory floor team leaders.

5.3. Results for Objective 1.

Objective 1 was to investigate 'what' information sales and operations managers need in order to make decisions that will have an impact on them meeting the strategic performance objectives, specifically around the sales and operational planning strategic objectives. This goes to what Blenko *et al.* (2010: 107) had to say about knowing what decision is needed to be made and what information would be needed to allow that process to work. In the questionnaire survey as illustrated in Appendix B and the interview questions as illustrated in Appendix C the following were the results and observations in respect of objective 1.

- Question 1 is related to the strategic objectives of the Sales and Operational Planning process as was surveyed in the interview questions (Appendix C) asked of the senior managers. The question provided four options to choose from and an opportunity to elaborate.
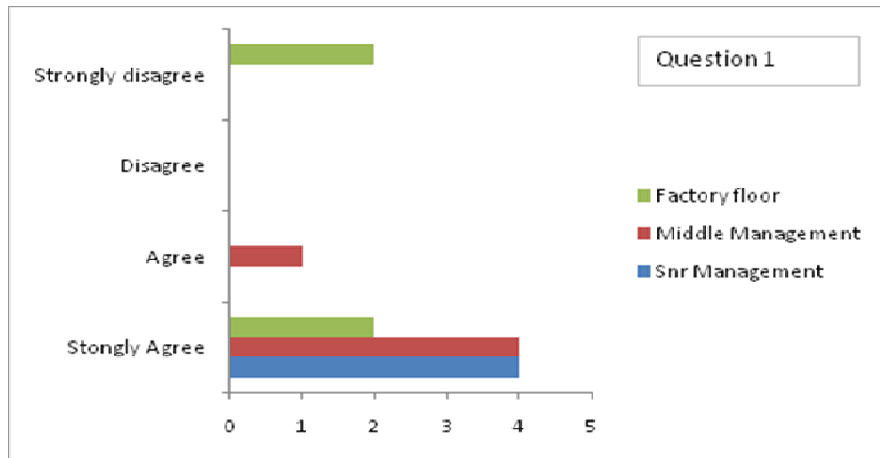
Table 5.2 Interview Response Question 1.

Function	Selection
Commercial sales manager	Meeting demand fluctuations and sales delivery
Planning manager	Meeting demand fluctuations and sales delivery
Procurement manager	Meeting demand fluctuations and sales delivery & Meeting quality targets at the expense of speed and cost
Production manager	Meeting demand fluctuations and sales delivery

As can be seen in Table 5.2, all senior managers responded to 'Meeting demand fluctuations and sales delivery' as being the most important performance criteria relative to their decision making process. With the exception of the Procurement manager who responded with an additional response of 'Meeting the quality targets at the expense of speed and cost'. The procurement manager's response and explanation during the interview was that just meeting demand fluctuations and sales delivery requirements without considering quality would be destructive. It is possible that the researcher was not clear enough with the selection provided as it would seem that the procurement manager did not read the third selection correctly as each selection was intended to be very specific and exclusive. The other three senior managers very clearly responded that their most important decision making process in meeting their strategic objectives was to meet the demand fluctuations and sales delivery. The production manager however added in his response that this criteria formed part of the holistic monthly Sales and Operational Planning action plan. He went on to describe that they have a very clear plan which identifies demand they are trying to satisfy, how they would address fluctuations in demand and how they will control quality and costs in achieving their strategic objectives.

The next part of the research was to establish the understanding of the groups of information prior to establishing from senior management 'what information' it is that they use in their decision making process.

- Question 1 of the survey questionnaire was asked to determine what the general understanding was on the importance of information within the context of PFK (2010) as illustrated in Figure 5.1.
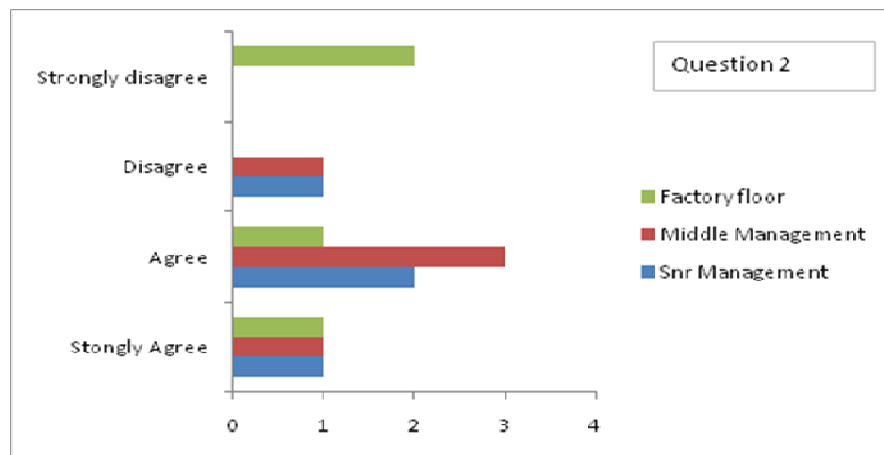
Figure 5.1.: Question 1 response from the questionnaire survey.

The results showed that from the perspective of senior management it is very clear that information is critical to the business with all respondents answering with a resounding 'strongly agree'. It is further significant that even from a middle management perspective it was predominantly the same with the exception of one respondent who still agreed with the statement but not as strongly. The result as shown is in line with what Fisher (2001: 75) had to say about information being the core asset of any organization. However it became interesting when observing the results of the four factory floor team leaders that were surveyed. With the results being so distinctly different, the researcher tried to establish what it was that made these results so radically different. It was established that the demographic of the team leaders (Factory floor management level) was two non-union and two union members which was quite unintentional. The non union team leaders responded in the same manner as senior and middle management by 'strongly agreeing' with information being at the heart of any business, and yet the union team leaders responded by 'strongly disagreeing' with the statement.

- Question 2 was asked to determine if there is clarity on what information is used in decision making in the Sales and Operational planning process within the context of PFK (2010) through the three levels of management. The results are illustrated in Figure 5.2.

Figure 5.2: Question 2 response from the questionnaire survey

Out of the senior managers the results were quite spread out, given the question if there was clarity on what information it is that they use in making decisions. The operations group of senior managers answered that they agreed or strongly agreed that they knew what information it is that they use in making decisions. It was a senior manager from sales and marketing that 'disagreed' that there was clarity about the information needed to make effective decisions. This confusion could be because of what Strong *et al.* (1997) spoke about as cited by Marshall *et al.* (2009: 3), where they stressed the importance that all stakeholders of decision making processes should make use of the same source of information and the stakeholders should have the skills to extract data from these sources.
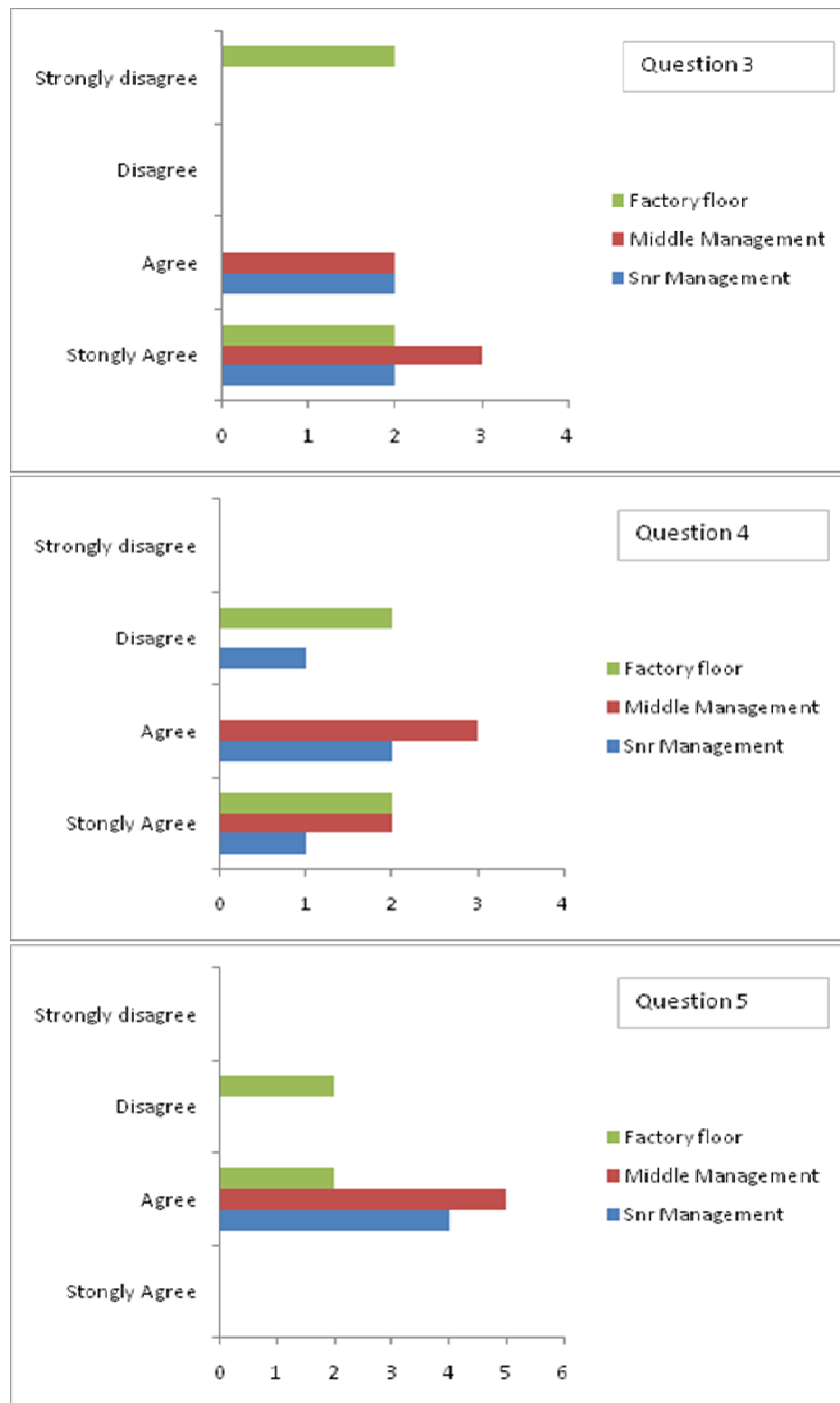
Middle management's response to the survey questionnaire had a similar spread to that of senior management with one of the population also disagreeing with the statement. This representative came from the planning office. This result would seem odd given the response of the planning manager and production members with whom the production planner interfaces.

The factory floor response was once again divided between the non-union members who agreed with the statement and the union members who 'strongly disagreed' with the statement that information needed for decision making was clearly defined. If the factory floor team leaders input to decision making was weighted it is likely in the opinion of the researcher that they are not directly involved in the SOP's decision making process but rather in the execution thereof.

In total, though, given the responses from the survey questionnaire, the majority of the sample population would agree with the statement that the information needed to make decisions in operations is clearly defined, thus supporting what was cited by Stapleton (2007: 75), linking the dependency of management decisions with collecting and making sense of information. This correlates with what Blenko *et al.* (2010: 107) also state that the key to gathering the right information is to think exactly what is required for critical decisions.

- Questions 3;4 and 5 of the questionnaire survey (Appendix B) are all written to test the sample population's understanding of information as being data to which some sort of knowledge or interpretation has been done to add value. Figure 5.3. illustrates response received.

Figure 5.3: Question 3, 4, 5 responses from the questionnaire survey

Senior management, middle management and non-union factory floor team leaders responded in nearly identical fashion. Note that the groups, as described in chapter 4, were surveyed at totally different periods, thereby avoiding respondents getting together to answer as a group. The result was very clear,

senior management, middle management and non-union factory floor sample population all have a very clear understanding about the definition of information and the concept of information being valuable only after some knowledge has been applied to it from the raw data. This would support how Stapleton (2007: 78), defined information as data that has been analysed in order to communicate meaning. It further supported what Checkland and Howell (Hinton, 2006: 63) had to say about the idea of information being selected data to which meaning has been attributed in a particular context. The results of this sample population would seem encouraging in their understanding, which is a foundation for decision making, as Miller (2009: 139) explained that information is the precursor to decision making.
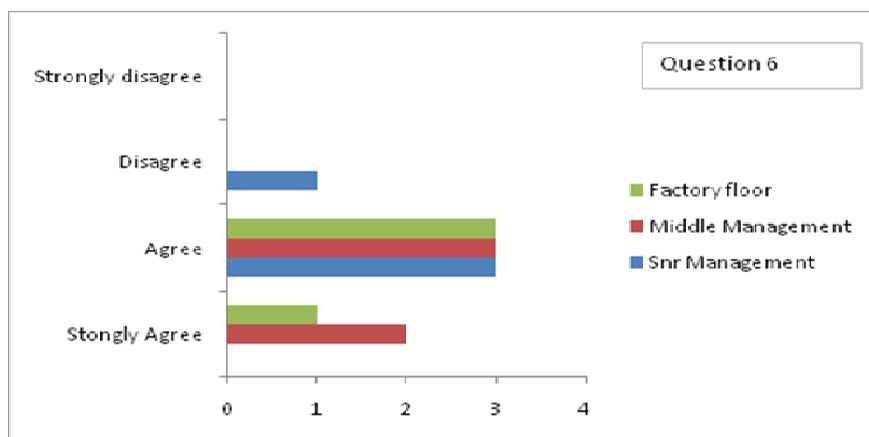
The results of the union members that form part of the factory floor team leader sample population once again demonstrated that there is a pattern of bias to answering survey questions. The union members responded with 'strongly disagree' to the question of data adding value unless interpreted and then a 'disagree' response to question 4 & 5 where the concept of information being data with some interpretation or knowledge being applied to it by support departments etc. The result in the researchers view could be biased and as was discussed in limitations described in chapter 1.

The results are crucial to answering the question within the PFK (2010) context as cited by Stapleton (2007: 80), "*Information should not be collected or passed on for its own sake, but only if it leads to increased understanding and added value.*" The results excluding the response of union members would suggest that the sample population would agree that information without having knowledge or interpretation done of some form would not add value to operations efficiency and effectiveness, confirming that within PFK's (2010) sample population the understanding of information is that it provides knowledge. This is confirmed by what Blumental (1969), cited by Badenoch *et al.*(1994: 11), had to say about data

being modelled, formatted or converted in a way that increases the level of knowledge to the recipient.

- Question 6 of survey questionnaire tried to establish how the sample population rated information, which they used daily. The rating of 'good information' was defined in the question as accurate, relevant and complete. The understanding of the quality of information was tested, using Eppler's (2006: 1) framework. Figure 5.4 illustrates the response.

Figure 5.4: Question 6 response from the questionnaire survey

Three out of four senior managers answered 'agree' to the question 6 statement, however the procurement manager answered 'disagree'. In the interview process (Appendix C) question 2 asked about the core information used in the decision making process, one of which was stock accuracy as reported by the sample population. In the follow up to the survey questionnaire the procurement manager was asked during the interview process, why the response of 'disagree' was selected in question 6 of the questionnaire survey. The answer to this was the concern about stock accuracy which has a big impact on the procurement decision making process in terms of material sourcing. His concern was not purely stock accuracy but aspects of stock reflecting as inaccurate due to delays in stock consumption transactions, given the method employed in reporting of stock consumption against 'manufacturing jobs'. The procurement manager states that
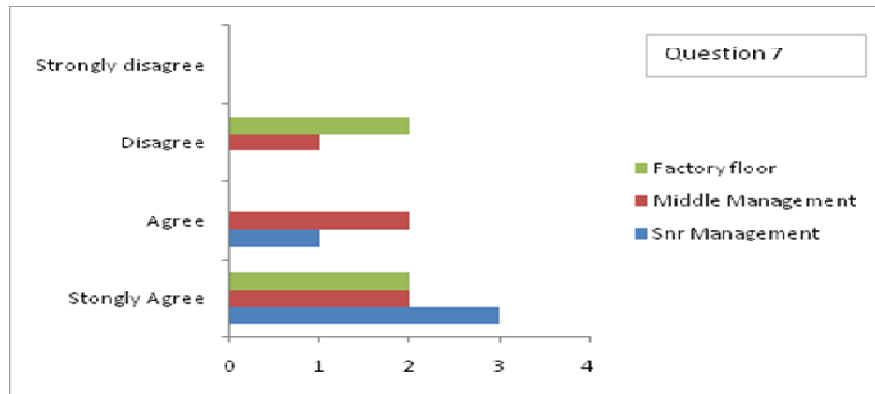
manufacturing jobs can take days and even weeks to be completed before it is reported into the ERP system.

Surprisingly, middle management and the factory floor team leaders all responded by agreeing or strongly agreeing that the information they utilized is accurate, relevant and complete. Even the union members responded in this manner. It would be difficult to respond to this question with any form of bias in terms of an ideological agenda, which could explain the result received from the union members sample population.

In general the response to this question showed that most were in agreement that the information they utilize is accurate, relevant and complete. Only the procurement manager had a concern about stock accuracy because of the time dependency of stock consumption reporting. The response to this question was in line with the theory, as cited by Stapleton (2007: 82) where the quality of information criteria of 'timeliness' has a significant impact on information quality. The introduction of time dependency on information quality, by the procurement manager, aligns with the theory by Badenoch *et al.* (1994: 16) where time has a relationship with the value of information. Badenoch *et al.'s* (1994: 17) two principle theoretical issues are therefore confirmed by the results achieved in the survey.

- Question 7 of survey questionnaire was directed around the Enterprise Resource Planning system and its use as a central information system from which information will be extracted. Figure 5.5 shows the responses from the sample population.

Figure 5.5: Question 7 response from the questionnaire survey

Question 7 specifically asks if a central information system (ERP database) will help in the decision making process.

Senior management and middle management predominately agree or strongly agree with that statement, which means that they all agree that the ERP system is the custodian of information; and that without this central information source, decision making would be more difficult. This result indicates understanding of the ERP system as being a tool for decision making, as a central source of information. This is as Stapleton (2007: 89) describes an information system to be. These results support what Checkland and Howel as cited by Hinton (2006: 63) said about the premise that information systems exist to serve and support people taking purposeful action (Decision makers). Heidmann (2008) cites Strong *et al.'s* (1997) research where the intrinsic data quality dimension is supported by research results achieved at PFK, namely that where discrepancies start arising on the data source, people will start having concerns about credibility and accuracy of data.

Once again, the factory floor team leaders were on opposite sides of the response with the non-union team leaders responding in the same way as middle and senior management, however union members disagreed with question 7. The reason for this response is described earlier, is possibly a culture response by the union membership.

- Question 2 of the interview (Appendix C) aimed to answer the question contained in the main objective 1, namely, 'what' information the sales and operational team need to make decisions. The senior managers of the sample population group responded. The results of question 2 are shown in Table 5.3.

Table 5.3 Interview response to Question 2.

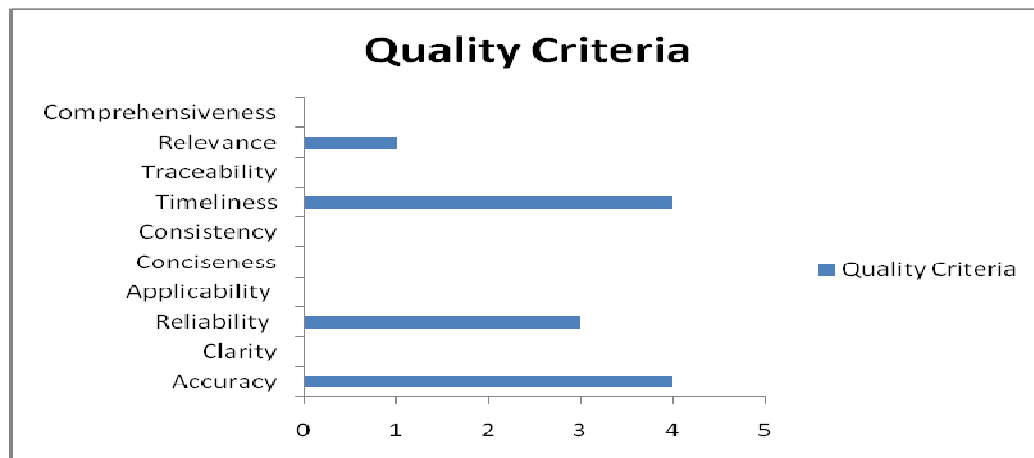| Information needed	Commercial sales manager	Planning manager	Procurement manager	Production manager
Forecasted sales demand	✓	✓	✓	
Actual sales orders	✓	✓	✓	✓
Drop in sales orders (Unplanned)	✓	✓	✓	✓
Raw material inventory levels		✓	✓	
Work In progress inventory levels	✓	✓	✓	
Finished goods inventory level	✓	✓		
Jobs currently building incl. qty		✓		✓
Rate at which producing		✓		✓
Resources required for capacity				✓

The interview process (Appendix C) identified 9 different forms of information required to make effective decisions based on the population samples responses. The researcher tabled the various responses to show common forms of information and others specifically needed by some resources of the sample population, to make their contribution to overall operations success.

Question 2 also asked (Appendix C) about the impact of information being gained from the shop floor in real time and what value that would add to the decision making process. All the senior managers responded with clear immediate answers naming core data they believe would have a significant positive impact if available in real time namely, raw material consumption, raw material levels in WIP locations, WIP progress against manufacturing jobs, progress to manufacturing job plan and rate of manufacturing. Each discipline were asked what would be specific to their needs, such as, sales wanting to know real time how their sales orders are progressing; planning wanting to know

rea time how their jobs are progressing; production wanting to know their performance to manufacturing jobs in real time and finally procurement wanting to know the status of raw materials being consumed in real time. This supports what Blenko *et al.* (2010: 107) said, that the key to gathering the right information lies in knowing what exactly it is that critical decisions require and getting that in a systematic way.

- Question 5 of the interview (Appendix C) tested the senior managers' response to information quality, as described in Eppler's (2006: 68) framework. In his vertical structure three aspects are covered viz., '*Relevant information'; 'Sound information'; Optimized process.*' The summary of the responses are shown in Figure 5.6.

Figure 5.6: Interview response to Question 5.

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As can be seen from Figure 5.6, the senior manager response was predominantly supporting the Eppler (2006: 68) framework by falling into the three vertical structures thus proving that Eppler's (2006) theoretical framework could be applied to defining the quality of information.

Badenoch *et al.*'s (1994: 17) two principle theoretical issues are therefore confirmed by the results achieved in the interview aspect of the survey, namely: the more effort the individual takes to process information, within the same context, the less relevant the individual finds the information and the second

being to simply ask individuals about the context and the criteria they use to value information, as shown in figure 5. 6.

The results as shown in figures 5.1 to 5.6 were obtained from the questionnaire survey (Appendix B) and population interviews (Appendix C) and the results support what Lubbe (2004: 7) and Marshall *et al.* (2009) argued, that decision making can become challenging and sometimes impossible if the data on which decisions are based are of poor quality, or if not taking cognizance of the qualitative properties of information. Marshall *et al.* (2009) went 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. The results also support four categories of data quality dimensions as defined by Strong *et al.* (1997) research, cited by Heidmann (2008). The results from the questionnaire also demonstrate, like Corrigan and Sphere (2010: 27) argued in their article, that information needs to be considered as an asset of the organization and that it is a time related asset.
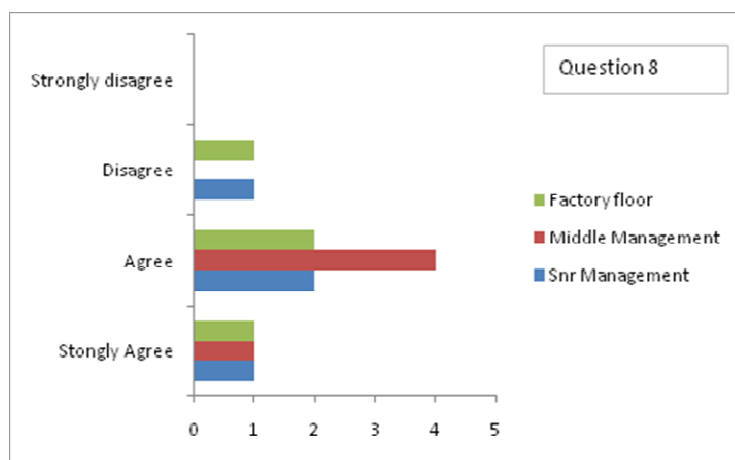
5.4. Results for Objective 2.

Objective 2 was to evaluate how real time shop floor data information can improve the decision making process in Operations, by understanding the type of decision making and methods used in decision making and the significance of the time dimension. The survey questionnaire questions 8-21 (Appendix B) and interview questions 1;3;4;7;8;9 (Appendix C) cover aspects pertaining to the dimension of decision making and impact of real time information.

Question 8;9;10 of the survey questionaire asks about having relevant information that you use in decision making as being readily accessible, as well as its relevance in a ERP system, with reference to information being in real time and accurate.

- Question 8,as shown in Figure 5.7 below ,responses were mixed with a majority of respondents saying that they agree that relevant information is readily accessible. However the procurement manager again disagreed with the statement. In the opinion of the researcher this could be a continuation of

concerns raised earlier about lags in the updating of data because of the methodology employed in raw material consumption reporting within Syspro (2011) ERP system. Senior management and the factory floor population responded in a identical manner with the majority spread in the 'agree' column and one response each in the 'disagree' and 'strongly agree' columns. Middle management were more optimistic in their responses by responding with the majority in the 'agree' column and one response in the 'strongly' agree column.
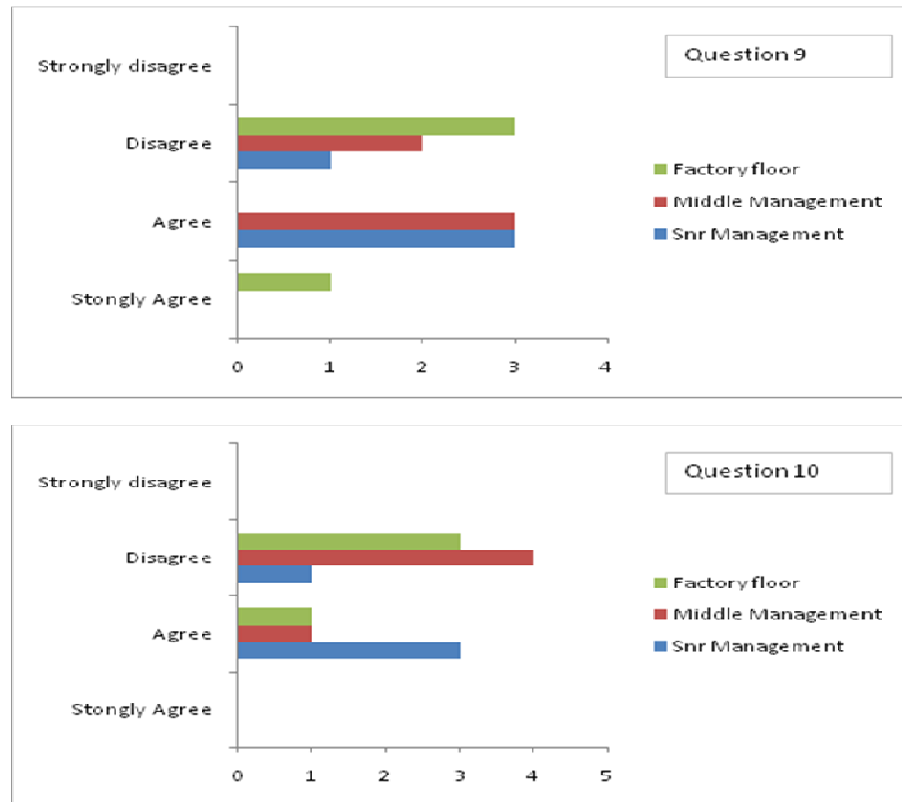
Figure 5.7 Question 8 response from the questionnaire survey

- Question 9 and 10 , shown in Figure 5.8 below, where both testing the sample population's response to whether the ERP system has real time visibility of information and that the information is accurate and current. Senior management with the exception of the procurement manager all responded by agreeing that the ERP system information was 'real time' and that the information was accurate and current. This is in strong contrast to how middle management responded. The middle management population responded with a divided response to question 9 on ERP information being available in real-time but the majority also 'disagree' that the information available on ERP is accurate and current. The factory floor responded very similarly to middle management, on question 9 Almost all believe that ERP information is not real time, and on question 10 on ERP information being accurate and current they almost all 'disagree' with the statement.

The responses received indicates that there is a problem in terms of information being readily available, ERP information being visible in real time and that information is accurate and current.
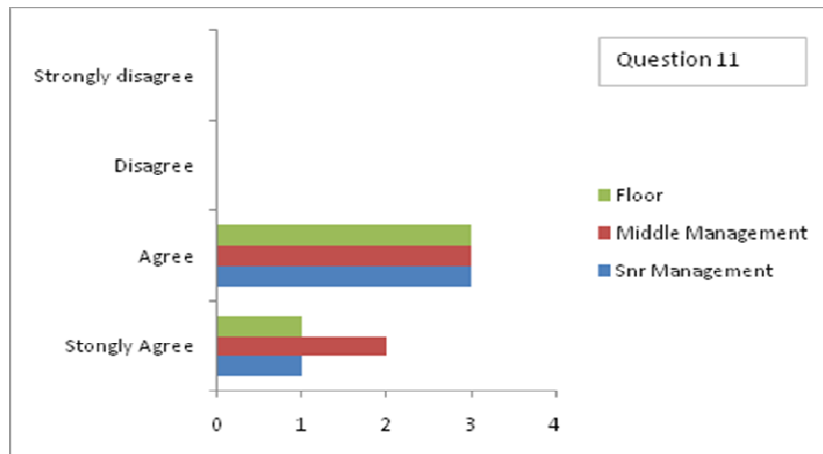
Figure 5.8 Response to Question 9 & 10 of survey questionnaire.

Marshall *et al.* (2009: 4) talk about Lui and Chi (2002) who classified data quality into stages and the response received from the PFK population would fall into the first three categories, namely, Collection quality; Organization quality and Presentation quality. Apart from the response received from senior management (excluding the procurement manager) the results would indicate that there is concern about the information and its quality and value. The procurement manager's response regarding the time lags and therefore the impact of the quality of information would confirm the impact of time on information value and quality as Badenoch *et al.* (1994: 16) stated in his theory on the subject. This is

also reinforced with what the Technology Center (2008) and what Syscom (2009) have to say about the need for real time shop floor data being critical to operations in meeting their missions.

Figure 5.9: Question 11 responses from the questionnaire survey

- Question 11of survey questionnaire in terms of objective 2 aimed to understand what the sample population thought about day to day decision making. The response to the questionaire survey is shown in Figure 5.9. As can be seen from the response all groups of the population believe that in day to day activity within the operations environment decisions are perceived to be made in a rational and logical way with all demographic groups either agreeing or strongly agreeing with the statement posed in question 11. This would support what Stapleton (2006: 14) had to say about operational decisions being routine and generally served by a rational approach.

- Question 7 of the interview process (Appendix C) probed the idea of the type of decision making models used by senior managers by presenting four models used to define decision making and after going through a descriptive process of defining those models the response is summarized in Table 5.4. below.

Table 5.4 Interview response to Question 7.

Function	Selection
Commercial sales manager	Rational
Planning manager	Satisficing (Based on rational model)
Procurement manager	60% Rational + 40% Recognition primed
Production manager	70% Rational + 30% Recognition primed

From Table 5.4 it is clear that there is a general thread of the rational model in all of the responses, with an addition of the intuitive model in two of the respondents. The two respondents that included both rational and recognition primed models state that it is because of the different levels of work that they do and different levels of resources that report to them and therefore the type of decisions that they need to make has made them select a combination of models.

This would correspond with what March (1978: 19) had to say about decision making processes that are often more complicated , confusing and erratic than either theorists or managers would admit. The results in Table 5.4 would also support what Miller (2006: 171) writes about Simon and March (1958) and their theory on decision makers making use of 'satisficing' strategies. However Miller (2006: 169) then also remarks that there is a movement away from rational models to models based on intuition which the results to question 7 would also indicate. The results might very well be what Miller (2006: 171) cites further about what March and Simon (1958) talk about in their 'bounded rationality' theory where the decision makers are attempting to make logical decisions but they are limited by their ability or time and resources.

- Questions 12 and 13 of the questionnaire survey asked the opinion of the survey population around effective decision making and its impact on improving overall

operations performance. The response to question 12 and 13 of the questionnaire survey is shown in Figure 5.10.

Figure 5.10: Question 12 and 13 response from the questionnaire survey

As the results indicate the response from the sample population indicate, for both questions, that they 'agree' or 'strongly agree' with the statement that effective decision making will certainly result in operations performance being positively impacted.

- Question 14 of the survey questionnaire asked about the KPI of On-Time-In-Full (OTIF) as being a good indicator of operational performance. The response to question 14 of the questionaire survey is shown in figure 5.11.

Figure 5.11: Question 14 response from the questionnaire survey

All of the sample population respondents 'strongly agree' or 'agree' with the statement that OTIF is a good indicator of effective operational decision making. An interesting observation is the full agreement of union and non-union factory floor team leaders who all 'strongly agree' with OTIF as a KPI.

- Question 15, 16 and 17 are survey questions which are very specific about which type of information, if available in real time, would have a great impact on decision making. It was asked to the entire sample population. The response to question 15-17 of the questionnaire survey is shown in Figure 5.12.

Figure 5.12: Question 15-17 response from the questionnaire survey

The result for question 15 relating to the availability of 'stock level' information in real time and its positive impact on decision making, shows that middle managers and senior managers predominately 'strongly agree' with the statement. The factory floor level was evenly split, with non union workers supporting middle and senior manager's stance on 'strongly agree' and union members, still positive about the statement, answered 'agree'.

The result of question 16 starts to see some bigger differences between the demographic levels with senior management all 'strongly agree' with the statement on the impact 'Work in Progress' (WIP) will have on decision making, whilst middle management, although still positive in general, were evenly split between 'agree' and 'strongly agree' possibly because of the extent to which they are involved in decision making. Once again, the factory floor predominately felt positive by picking 'agree', but it could also possibly be because of their limited knowledge and involvement in the actual decision making process, that affirms their belief that it will have an impact, but to a lesser degree than what senior management would understand the impact to be.

The result of question 17 asks about the resources constraints and having this in real time. The idea with this question was to determine the respondents' ability to understand what the impact of resources, in the form of people and equipment, might have on decision making in terms of operational decisions in achieving OTIF. Senior management did not feel that strongly about the impact of having this information in real time, even though they still 'agree' that it will have a positive impact. Interestingly, middle management felt stronger about the impact of this information by predominantly answering 'strongly agree' thus communicating the importance in their view on decision making. As expected the union and non union response was split evenly, with non union factory floor team leaders being more positive about it's impact by answering 'strongly agree' while union workers only 'agree'

The results of questions 15-17 touch on two aspects of theory, which relates to what Corrigan *et al.* (2010) had to say on the value of information as being an asset to the organization, but it is a time related asset. There by relating the importance of the time dimension confirming the significance of 'real time' information and its value to decision making. The notion of real time information relates to what the Technology Center (2008); Wallace and Kremzar (2001) and

Syscom (2009) all talk about in the relevance of real time information making a profound improvement to making operations more effective and efficient.

The information listed in question 15, 16 and 17 relates back to the response received from senior management in question 2 and 3 of the interview process (Appendix C) where they were asked specifically about the impact of having real time shop floor information available for decision making and what that information would be; and this corresponds with information used in the questionnaire survey, even though it was worded differently (see objective 1)

- Question 3 (Appendix C) very specifically asked how they, as senior managers, would evaluate having real time information and the impact they believe it would have on their decisions to achieve >95% On Time in Full (OTIF) as KPI. The response from the senior managers was as follows;

  o The commercial sales manager simply said that it will be 'significant' as it would allow them to have real time job progress which would allow them to confirm delivery and shipment dates with customers ,as well as having early warning should they see a manufacturing job running late. It would give them more confidence when talking to customers about their orders.

  o The planning manager said the impact would be enormous for the next significant step in them achieving progress as far as the implementation of a planning and scheduling system. The reason given was that, having a view of what production is actually doing in relation to their plan, would make expediting or moving of jobs to the benefit of achieving OTIF targets easier. Furthermore, they are planning to try and level capacity by using economic batch quantities (EBQ) which does not always make for flexibility when they have resource constraints, which were unknown and delivery is imminent. This will allow for a judgment call and decisions that would better serve customer OTIF at the expense of following their ideal plan. While referring to analysis of Drop in orders (Appendix D), they said

that if they had real time information, they could make better decisions as they would have a precise and current view of raw material stock and work-in- progress which might include additional products that could be sold because they manufacture in economic batch quantities.

o The procurement manager states that the impact would restore his confidence in the accuracy of the data because of the time lag problem that would have been removed. This would allow them to see actual stock as consumed through manufacturing jobs as they are processed rather than only after going through manufacturing lead time then reporting consumption, meanwhile they still see stock availability and do not procure stock. The procurement manager recounts a recent problem they finally understood. They have a component (relay) which every now and then they stock out of this component which impacts directly on customer OTIF. They did everything in their ability to prevent this, even going as far as having safety stock in raw material form to absorb some variance in demand, yet they still stocked out. After doing a route cause analysis with a multiple discipline team, going back four months of demand and manufacturing job analysis, including understanding the manufacturing process, they established that the manufacturing lead time was up to 15 days before raw material use was reported. This, in conjunction with 3 consecutive months of additional customer demand and a component procurement lead time of 90 days, resulted in stock outs. Had they had real time information on consumption as used they could have avoided the stock outs as well as pressure of impacting on OTIF and additional costs of expediting component purchasing and shipping. If you look at the 'cross functional' minutes (Appendix E) you will see the impact of having to manage manufacturing build schedule based on shortage of raw material availability. In theory PFK buy components to forecast demand so we should not have component shortages, however we buy based on demand against our current stock. The problem is that the current stock

does not reflect real time and thus procurement department are responding to lagged information.

- o The production manager response was 'very definitely', allowing him to monitor actual rate at which they are producing against the working standard allowing efficiency measurements, as well as being able to respond to disruptions in a more flexible manner so they can ensure OTIF performance at the right cost and quality, so fundamentally impacting on decision making. The production manager also referred to the 'cross functional' minutes (Appendix E) and how they are trying to manage and make decisions to meet their KPI of >95% OTIF by managing cost and quality because they do not have real time information and the time lag results in problems such as component shortages or manufacturing jobs that in sequence where not completed in time, thus impacting manufacturing operations further down the process. If they had this information in real time it would have a big impact on making better decisions.

This is supported with what the Technology center (2008:1) talks about when not having an accurate unified source of information; it will limit the ability to respond in a timely and profitable manner. Orian (2011) also refers to 'manufacturing intelligence' which delivers 'real time' visibility and provides analytics on key performance indicators (KPI's).

Thompson (1967) as cited by Stapleton (2006:32) maintains that where making of decisions involves beliefs or assumptions as to what will happen if one course is taken rather than another and preferences to what is most desirable, there is less certainty about some beliefs and preferences than others

- Question 4 used Thompson's (1967) four strategies as cited by Stapleton (2006: 34) to describe and illustrate to the sample population the contexts, so that they

could choose the environment that best suits their decision making context. The results are shown in Table 5.5 below.
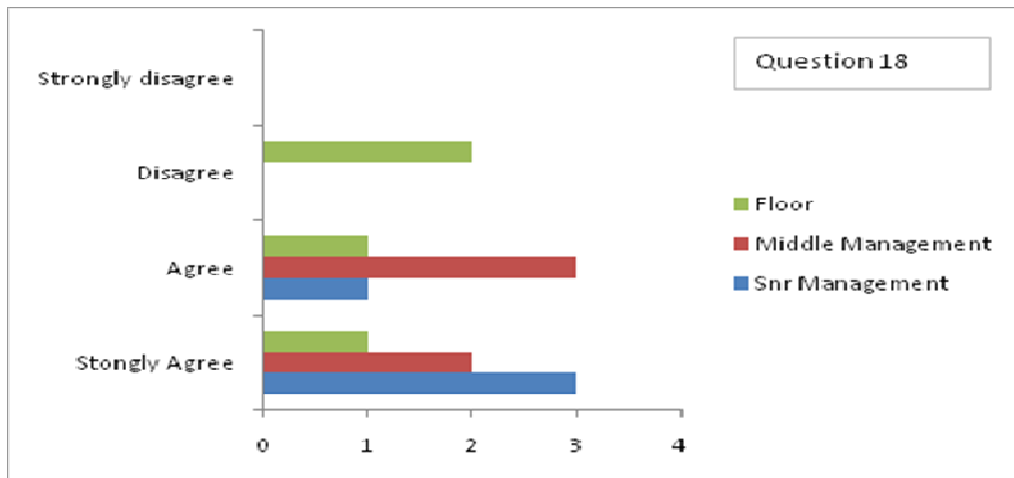
Table 5.5 Interview Response to Question 4.

Function	Selection
Commercial sales manager	Computational strategy
Planning manager	Computational strategy
Procurement manager	Computational strategy
Production manager	Computational strategy

The results of question 4 are unanimous and all senior manager respondents agree that the decision making context they work in is a 'computational strategy' environment, meaning that they have high technical certainty, meaning they know how to respond or have the skill to do the job, and they have high goal clarity and consensus. Both of these dimensions are explored further in questions 18, 19 and 21 below.

Question 18 was asked to test the sample population's perception of the skill of managers in operations decision making as Marshall *et al.* (2009) noted that Strong *et al.* (1997) had found that there is a link to the skill of individuals who source information and their ability to extract data in time for the information to be useful in decision making. The response to question 18 of the questionnaire survey is shown in Figure 5.13.
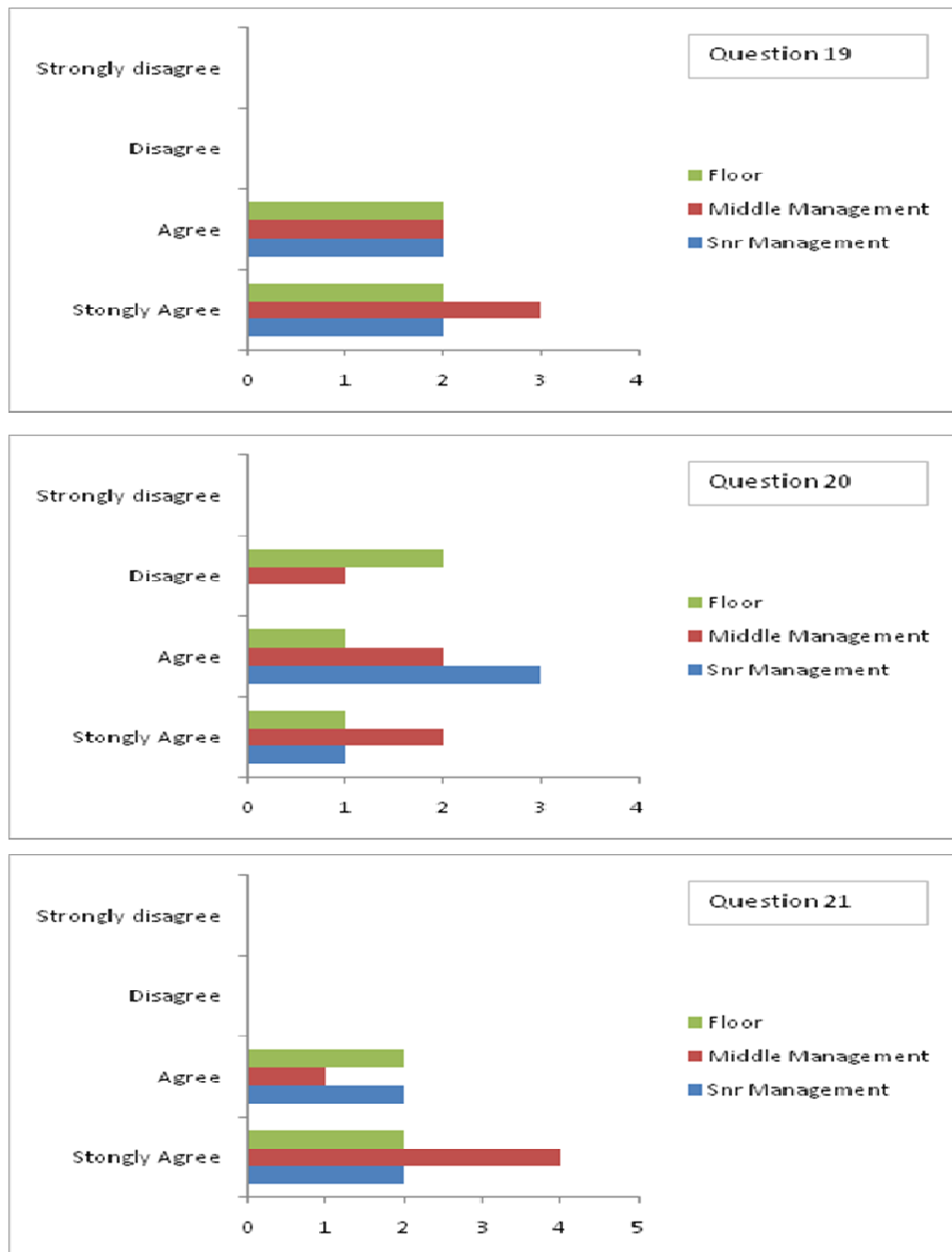
Figure 5.13: Question 18 response from the questionnaire survey

The results indicate that senior management 'strongly agree' that they have the skills necessary to extract data in time for the information to be useful. This however could very well be a biased answer. It is middle management and factory floor team leaders that should provide an unbiased view, given they are not the demographic that is being evaluated. Middle management's response was positive with most picking 'agree' and the balance 'strongly agree' that managers making the decisions have the skill. This result was reinforced by the non union factory floor team leaders who answered pretty much the same as middle management. However again the union members 'disagree' thereby saying that they believe managers do not have the skills required to make decisions.

- Questions 19-21 that were asked in the questionnaire survey to all demographic groups was about an all around strategy and its link to decision making. The response to question 19 - 21 of the questionaire survey are shown in Figure 5. 14.

Figure 5.14: Question 19-21 response from the questionnaire survey

Question 19 asks the survey group if they believe that the Operations strategy is aligned to PFK performance objectives. The results as can be seen in Figure 5.14 indicate a positive response from all in the sample population and the positive response is evenly split between all demographic groups between

'agree' and 'strongly agree'. This is a good sign that the strategy is clear and communicated and it would seem that all demographic groups have a common goal. This confirms what Fenton-O'Creevy (2007: 24) talks about in the use of the EFQM (2010) framework and how it aligns all stakeholders to common goals and taking a holistic view on the implementation and measurement of performance. The EFQM framework as cited by Fenton-O'Creevy (2007: 23) is useful in developing a shared vision and goals and it helps to identify linkages and cause and effect relationships, thereby allowing for a holistic view to performance.

Question 21 results will support the EFQM framework being used to some success as it indicates in Fig, 5.14 that all agree and some strongly agree that the operational strategy has clarified goals thereby assisting in decision making.

Question 20 refers to PFK (2010) being a learning organization and is intended to test the sample population's perception. The topic is further interrogated in the interview survey through question 9 which asks more specifically about frequency and means used to document lessons learnt. The topic also then starts touching on the culture within PFK which is tested through question 8 of the interview survey. As Fig. 5.14 shows, the results of question 20 indicate that senior management predominately 'agree' with some senior managers 'strongly agreeing' thus indicating that senior managers are convinced that PFK is a learning organization. The results of middle managers are similar to senior managers with one single person 'disagreeing' but middle managers predominately 'agree'. Looking at non union workers they just like senior managers are split between agree and strongly agree thus being positive about the PFK being a learning organization, yet once again the union factory floor team leader's response is negative with a 'disagree' response.

- Question 9 of the interview process (Appendix C) aimed to get a more detailed response from senior managers. The results are shown in Table 5.6 below.

Table 5.6 Response to interview Question 9.

Function	Frequency Selection	Method selection
Commercial sales manager	weekly	corrective actions
Planning manager	weekly	change notes; MDWT
Procurement manager	weekly	change notes; corrective actions; MDWT
Production manager	weekly	change notes; corrective actions; works instructions

These results indicate that all respondents are updating lessons learnt on a 'weekly' basis at the very least. This indicates that this is a very active learning organization. The methods used are different and seemingly dependent on the discipline and they are described within the PFK context as follows;

- Corrective actions, are internal or external customer complaints or non conforming products or processes. These will prompt some root cause analysis and remedy to be applied. The remedy's are documented in change control or works instructions or through Mission Directed Work Teams interfacing.

- Change notes, are formal process where an improvement or change is noted with actions and deliverable dates that are permanently recorded in various places, for example, Bill of material or works instruction or procedure.

- Mission Directed Work teams (MDWT, 2011) is a management tool used to get teams at all levels working off the same common goals and values of the organization, but empowering them to manage their own mini business.

- o Work instructions are formal documents which specify exactly the method need to perform a task or operation, including safety and quality aspects.

These results need to be viewed within the context of the culture within the organization.

- • Question 8 of the interview process attempts to determine very quickly the perceived behaviour culture within the organization, using Handy's (1988: 59). The response was unanimous as shown in Table 5.7 below.

Table 5.7 Response to interview Question 8.

Function	Selection
Commercial sales manager	Power
Planning manager	Power
Procurement manager	Power
Production manager	Power

The senior managers interviewed all define the behavioural culture within PFK as a 'power culture'. Handy (1988: 59) defines power culture at best pictured as a 'web' with the decision makers in the center of the web. Handy (1988) further describes that the organization exists to enable the decisions of those at the center to be carried out, type of culture often found in small entrepreneurial companies. It is a personal culture in the sense that communications are between people as individuals rather than between formal job holders or departments. Handy (1988) states that the key to success is in employing the right sort of people.

The results indicate that within the 'power culture' at PFK the sample population would agree that it is a learning organization and that it is documenting lessons learnt thereby sustaining learning, with the union members differing on this view. This would lead to the understanding of flexibility of the operations team; given

what Stapleton (2006: 22) had to say on internal environment (culture) allowing decisional bias to be overcome by encouraging discussion.

In summary, objective 2 is about the impact that 'real time' shop floor data will have on decision making within operations, thereby addressing the topic of time influence on the value of information during the decision making process. The results achieved provide an understanding of the behaviour culture within PFK, the type of decision making methods employed by operations decision makers and the impact that real time will have on that from the perspective of the sample population.
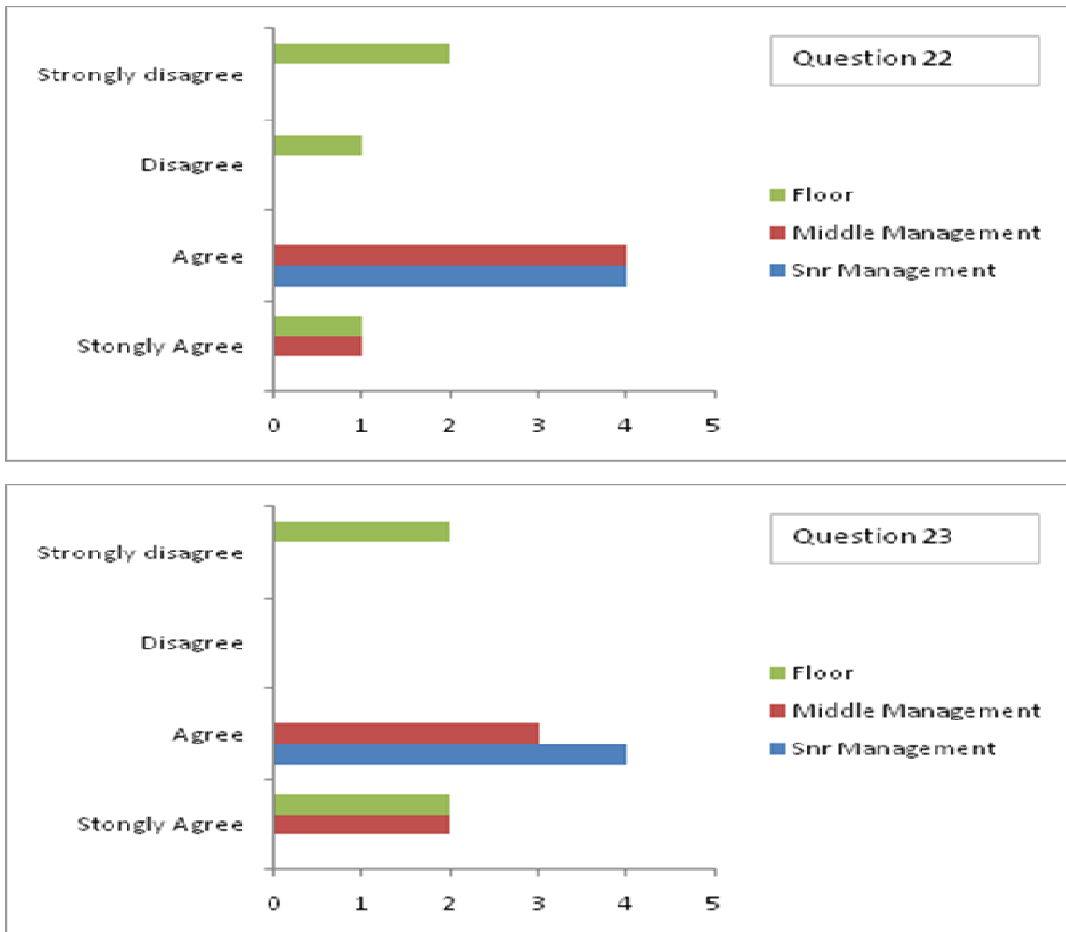
5.5. Results of Objective 3.

Objective 3 was to recommend suitable Information Communication technology (ICT) systems to obtain and communicate information to managers effectively within operations. Question 22-24 of the survey questionnaire attempts to shed light on the flow of information in the current system setup. Interview question 6 is attempting to establish the types of communication within operations with the intention of understanding how ICT technology would impact as objective 3 intends to recommend a solution.

- Question 22 & 23 results of the questionaire survey are shown in Figure 5.15.

Question 22 targets what Stapleton (2007: 87) expressed about communication of information. It is only useful if it is managed to reach those that need it, otherwise the effort of producing information was a waste. From Figure 5.15 it is clear that there are two different results, senior management and middle management 'agree' that information flows to the correct recipient, yet apart from one respondent all of the factory floor team leaders 'disagreed' or in the case of union members 'strongly disagree' with the statement.

Figure 5.15.: Question 22-23 response from the questionnaire survey

Looking at response of question 23 to establish possibly why the factory floor had such a negative response to question 22, the question asked about how management structure aids in information flow. The results show that senior managers, middle managers and non union factory floor team leaders would agree that the management structure does aid in information flow. As expected given previous bias, the union members in reference to any management structure have come out as 'strongly disagree'.

- Question 6 (Appendix C) of the interview questions attempted to define the style of communication that is current within operations using Tannenbaum and Schmidt's (1973: 10) classic management style. Table 5.8. summarises the responses received from senior managers that were interviewed after describing

and defining Tannenbaum and Schmidt's (1973: 10) classic management style diagram.
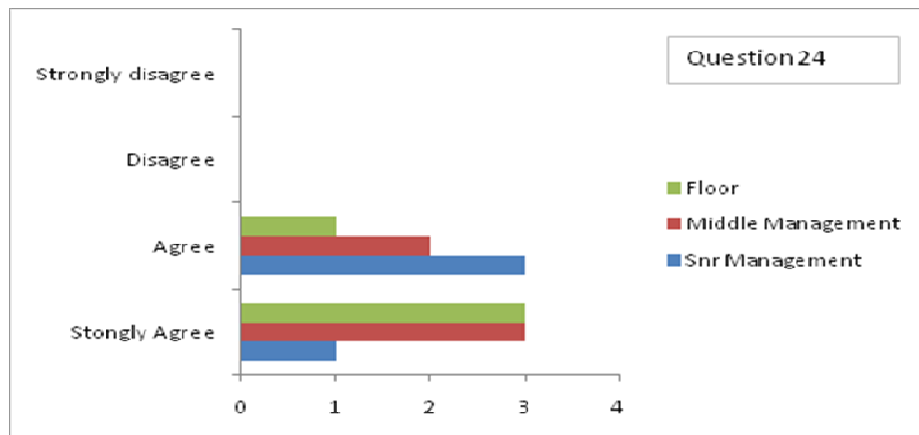
Table 5.8: Response to interview Question 6

Function	Selection
Commercial sales manager	tells
Planning manager	joins; tests; tells
Procurement manager	consults
Production manager	consults

The commercial sales manager in his response to the context of decision making states that he as manager makes the decisions. The planning manager describes that it is dependent on the audience what type of context decisions are made; with other senior managers the respondent describes 'joins' which allows subordinates more freedom and less authority as leader. When it comes to middle management the respondent selected 'test' where ideas are presented and questions invited, giving less freedom to subordinates. Lastly the planning manager, when dealing with the factory floor selected 'tells' where as a manager the decision was made and subordinates had little freedom.

The procurement manager and production manager both selected 'consult' as the context within which they make decisions, resulting in the manager presenting problems to the subordinates and then getting suggestions prior to making decisions, possibly indicating the need for information from subordinates before making decisions. It does make the results received from union workers look even more biased if this is the way the production does in fact make decisions looking at the response received from union members to question 22 and 23.

- Question 24 asked the survey population through the survey questionnaire (Appendix B) if they believed that the ICT system can be enhanced to improve delivery of information, alluding to real time information systems tied into the ERP system. The response to question 24 (Appendix B) is shown in figure 5.16.

Figure 5.16.: Question 24 response from the questionnaire survey

The response clearly shows that the whole demographic group of the sample population believes that there is room for improvement in ICT systems that can improve the delivery of information. Eppler (2006: 67) describes four levels of qualification to improve the quality of information, where the fourth one is 'reliable infrastructure' criteria which relates to the infrastructure on which information is provided, thereby indicating the significance of the question 24 response on the quality of information.

5.6 Summary of findings.

This chapter reviews the results in summarized form in terms of the original thesis question and objectives decided in chapter 1 and ends with recommendations for activity following the research conclusions.

A general observation prior to discussing the summary of findings is the definite bias to the answers provided by union team leaders all through the survey questionnaire. The researcher had to question if the answers provided by union members all be biased

around ideology rather than the brutal facts? The results would seem to be reflecting two opposing cultures. The results of the interview process showed PFK behaviour culture to be defined as a 'Power' culture which, as described by Handy (1988: 59) is entrepreneurial and it has shareholders that expect returns through profits based on capitalist principles. NUMSA is the trade union to which members at PFK (2010) belong and it is cited by NUMSA (2011) as being a socialist movement looking out for the workers against the bosses and therefore could be defined by Handy (1988) definition as a 'Person' culture.

These two cultures have conflicting principles that would seem to have manifested in the negative results received from the union member team leaders sample population as NUMSA's principles propagate divides as is cited by NUMSA (2011), *"Numsa's long term vision is of a united South Africa where the minority will no longer exploit and oppress the majority. For many, this is the socialism that we are still striving for. An organised and united working class must make sure we achieve this goal.*

Numsa's principles and policies stem from an analysis of where workers get their power from.

Workers are not like bosses. They cannot buy power with money. Workers get power from:

- *numbers - workers are many, but bosses are few.*
- *unity - workers are strong when they act together but weak when they are divided.*
- *organisation - trade unions organise workers to act together and be united.*
- *industrial action - workers do the work, if workers refuse to work there is no production and no money for the bosses.*
- *protest action - having pickets and demonstrations tells the government and/or bosses what we feel and puts pressure on them to listen to our demands.*
- *solidarity - we can use the power of the community or the whole industry to help our struggle."*

5.6.1. Results of Objective 1

Objective 1 was to investigate 'what' information is needed to make effective decisions that will let the sales and operations team achieve their performance objectives.

The first issue was to determine what decisions the sales and operations team need to make to achieve performance objectives. The results from the research were that it was decisions based on 'meeting the demand fluctuations and sales delivery.' Therefore the types of decisions being made will be to satisfy these criteria.

Before asking the 'what' information they need, the researcher wanted to establish the sample population's understanding of 'information' and the importance of the quality and value of information, in an attempt to improve the validity and reliability of the sample populations response.

The summary of this was that the sample population understood that :

- Information is the heart and soul of every business, and that the information needed to make effective decisions in PFK was clearly defined.

- The sample population are very clear that data on its own holds little value but once interpreted or some form of sorting or filtering has been applied, it becomes information, and that support departments that supply them information have interpreted the data prior to supplying it to them, thus adding value.

- The sample population generally agrees that they use good information, meaning it is accurate, relevant and complete; however it is very vulnerable to impact of time when it comes to accuracy within the ERP System. This correlates with what Marshall *et al.* (2009: 3) stated as a widely accepted fact, that if information is fit for use for which it is intended, then it is good quality information.

- The quality of information is defined by the sample population interviewed to have the following criteria, Timeliness; accuracy; reliability. Eppler (2006: 70) cites what Evans and Lindsay (1999) cover in their criteria of quality that the manufacturing based criteria for quality is timeliness. Also Naumann and Rolker (2000) say that process orientated criteria will be based on time and availability, which correlates with what the results of the PFK (2010) survey found.

- Having ERP information does simplify decision making which supports what Buckland (1991) stated as cited by Lubbe (2004: 5) that information technology can increase the specificity of the information especially the time factor. It also support what Syscom (2009: 1) had to say about what an ERP system should do, such as providing an enterprise wide view which should allow for better informed decision making.

These results clearly demonstrate that the sample population does have a good understanding of information and the value and quality of information required to make decisions.

Considering 'what' information is needed to make effective decisions, the research results show in Table 5.3. above the information required by sales and operations decision makers to achieve the strategic objective of > 95% OTIF.

5.6.2 Results of Objective 2

The second objective of the research in testing the thesis statement was to evaluate 'how' real time shop floor information can improve the decision making process, by understanding the type and method used in decision making.

To evaluate the impact of 'real time' shop floor information on decision making the researcher needed to determine the methods used in decision making, needed some feedback on the quality of information stored by the ERP system and then asked specific questions about the impact of real time shop floor information.

Staying with objective 1, the quality and accessibility of information available in the ERP system was tested and the result from this was:

- That information relevant to decision making is readily accessible from the ERP system. This supports what Madapusi (2008) stated that ERP systems seamlessly integrate data from different functional areas to provide information for decision making.

- The sample population response to ERP information being 'real time' was so divided that it is difficult to simply answer; and this alone shows that there is a concern. Madapusi (2008) quoted Davenport (1998) as saying that the use of the same information by different decision makers has made the need for high quality ERP information to allow for effective decision making.

- The majority of the sample population agree that the information resident in the ERP system is not accurate because it is not current, providing more clarity on the previous question.

In determining the type of decision making methods used the researcher prepared some general sample population questions as well as specific interview questions posed to senior managers of the sample population. The results are summarized as follows:

- The sample population believe that day to day decisions are rational and logical.

- The sample population believe that effective decision making will improve performance, thus not having quality ERP information (time/accuracy dimensions) will result in less effective decisions as correlated with Madapusi's (2008) comments.

- That OTIF is the KPI best used for measuring effective decision making and good barometer of sales and operations performance.

The type of decisions making method was determined through the interview process (Appendix C) and the following summarizes methodology,

- All interviewed senior managers predominately follow rational and logical methods of making decisions which supports the survey questionnaire response on the same topic. However, some managers are also doing some intuitive decision making which also follows some logical approach because of the nature of the work they are involved in, that it suits the context and achieves the desired results. The specific results are shown in table 5.4. above. This supports what

Miller (2006: 172) cited about research that Burke and Miller (1999) did on intuitive decision making where their study showed that when managers were asked about whether they used intuition in decision making, 10% responded that they seldom or rarely used intuition , thus around 90% of managers in that study did use intuition in decision making, also possibly meeting what March and colleagues (1972) referred to as the 'garbage can model' (Miller, 2006: 173).

Evaluating the impact that 'real time' shop floor data will have on decision making effectiveness, the questionnaire survey and the interview process asked very specific questions to gauge the impact as the results below summarises.

From the survey questionnaire the following was determined:

- Having component real time stock level information; having real time work in progress information by manufacturing job number and having real time information on resource constraints, the sample population strongly agree will have a big positive impact on their decision making. This is supported with what Blenko *et al.* (2010: 107) states that you cannot make good, fast decisions without information in the right place at the right time. This is also supported by Eppler (2006) and Corrigan (2010) who comment on timeliness of information.

This was further explored in the interview process with the results of question 3 (Appendix C) asking specifically how the senior managers would evaluate the impact of having the information they specified in Table 5.3 above in real time on them achieving >95% OTIF as performance objective. The result of question 3 supports the sample population interviewee's view that real time shop floor information would have a significant impact on their decision making. The impact of this was described in their interviews which identified the impact as currently not having real time shop floor data and how this influences operations decision making and how it manifests, as shown in appendix D & E.

The research has also shown through the results of the population survey that everyone, excluding the union members, believe that management have the necessary

skill to make decisions. The research went further to determine if the population samples believe that operational strategy is aligned to PFK performance objectives and that the goals are clear. The response was clear and the whole of the sample population agree that operational strategy is aligned to PFK performance and goals are clear.

The research survey went further to get a response about the environment and culture by surveying the sample population on whether PFK is a learning organization. Senior, middle and non union team leaders stated that they 'agree' that PFK is a learning organization and yet the union team leaders 'disagree' with the statement. Question 9 of the interview process tested the notion of PFK being a learning organization, by probing through which mechanisms they document learning. It was established that with a weekly frequency and through corrective actions (root cause analysis); change notes; works instructions and the MDWT forum, lessons learnt are documented.

Leading into this the researched through question 8 of the interview process (Appendix C) the behavioural culture within PFK was described as a 'Power' culture, as defined by Handy (1988).

5.6.3 Results of Objective 3

Objective 3 was to recommend suitable ICT systems to obtain and communicate information to managers effectively. The research intended to establish how information currently flows and what style of communication is visible within the sample population and finally if the sample population believed that an OCT system could enhance the delivery of information.

The results of the research established that there are two distinct different perceptions, that of union and non union (all levels). Senior, middle and non union team leaders all felt that information flowed to the correct recipient and that the management structure aids in the information flow, yet union members strongly disagree with this. Question 6 of the interview process (Appendix C) response to the type of communication, the results revealed that different types of styles are used depending on the audience.

The research results also show that the whole of the population including the union members agree that there is room for improvement of the ICT system in delivering information.

The results of the research, however could not assist in a recommendation of a suitable ICT system as was intended in objective 3.

Chapter 6: Conclusions and Recommendations.

6.1. Discussion of problems encountered in the research.

One of the problems encountered was that the researcher under estimated the need for understanding of ICT systems knowledge, which could have been acquired, but not in the time frame available to understand and research suitable ICT systems that could be recommended to improve information delivery as was mentioned in research objective 3. This was brought up in the 'limitations' section discussed in chapter 1 subsection 1.5, Delimitations and Limitations, where it was stated that the research could be limited by understanding of the Sales and Operational processes which would also now include the technical aspect of the ICT systems. However this does not impact directly on the researchers work in answering the thesis statement which is the core of the research problem.

6.2. Conclusions.

The problem statement developed had established three objectives that the researcher was going to research that would assist in answering the research question which was,

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

From the research that was conducted using a sample population that was defined in Table 5.1.which would represent the whole population of PFK (2010), the following conclusions can be made from the objectives that where set out and the results analysed.

From objective 1 in the introduction to the research problem, the intention was to establish 'what' information was required to make effective decisions that would allow the Sales and Operational Planning team achieve their performance objectives. In doing the research, the following can be concluded from the results namely:

- The PFK population has a very good understanding of the value of information in decision making and that 'time' is a significant dimension in the value and quality of information.

- That the ERP system implemented at PFK (2010), Syspro (2011), is the central data source of information and that the ERP system simplifies decision making.

- The information needed is reliably presented in the ERP system, yet it is inaccurate in terms of the information stored in non real time and thus is lagging.

It can further be concluded that the information needed to make effective decisions as described in objective 1 are shown in Table 5.3. earlier, therefore achieving objective 1. The information required is based around the customer demand required to be satisfied, the current status of raw material and work in   progress of current manufacturing jobs and the resources utilization. The Sales and Operational Planning decisions are based on the best information available in the ERP system including the time lags resident due to the methodology employed in manufacturing jobs and reporting stages.

In respect of objective 2 of the research problem, it required the evaluation of 'how' real time shop floor information can improve decision making. From the results summarised in section 5.6. and as described in chapter 5.4 the following can be concluded:

- Because the information resident in the ERP system database (Syspro, 2011) is not reflecting actual current status due to delays in reporting of stock consumed and WIP against manufacturing jobs for example, all decisions made will have inherent error and risk associated with them as was reflected in the minutes of the cross functional meetings (Appendix E) which documents the management impact of these decisions.

- It can be further concluded from the results analysed that the SOP's decision makers are making decisions based on rational and logical processes predominately with some intuitive decisions also being made, that are based on previous logic, using information they know is not accurate due to time lags sourced from the information resident in the ERP system.

- It can be further concluded from the results that the EFQM (2010) model of goal alignment is an effective means of aligning and managing the Sales and Operational planning teams in meeting strategic objectives.

- It can also be concluded from the research done through the survey questionnaire and the interview questions that effective decision making by the SOP's team is limited by the timeliness of data and that having 'real time shop floor' information would significantly impact and improve the effectiveness of their decision making in achieving their strategic performance objectives.

- The results of the research also allow the researcher to conclude that the management team have the necessary skills to obtain information from the ERP system and make decisions. Thereby concluding that decision making effectiveness can be improved by having better quality information and by obtaining accurate 'real time information'.

The researcher has also concluded that almost all of the union team leader's responses were biased negatively and that this is mainly due to the Union culture which could be defined by Handy (1988: 60) as a 'Person culture', rather than the actual situation given the responses received from the same level of the sample population but who are not unionized team leaders.

Therefore it can be concluded that if operational effectiveness can be put into the form of mathematical understanding then,

Good quality information (Timeliness, accurate, reliable) will allow for improved Decision making = Better operational effectiveness, as Gibbons (2011) described in research done by Bain and Company Inc.

This should then result in a more profitable organization as the operational efficiency will impact the profitability through reducing operating expenses, thus increasing the effectiveness aspect of Return on Capital Employed calculation by increasing the operating profit.

Therefore this research has concluded that if information can be obtained closer to real time into the ERP system (Syspro, 2011), then based on information needed by decision makers, operational effectiveness can be improved which will contribute to the strategic objectives of operations by the benefiting PFK (2011) as described in section 1.6 of the introduction namely, quality, speed and cost.

So in conclusion the thesis question asked was, *"Will having core real time shop floor information allow operations to achieve strategic objectives by improving decision making"*

Based on research presented the researcher is of the opinion that the results are reliable and valid if tested and therefore based on the research report results presented here, the research /thesis question in the opinion of the researcher can be answered 'YES'.

6.3. Recommendations.

The researcher has identified 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. Therefore, further research into the technical aspect of linking 'shop floor' data into the ERP system is required and this should be further explored to determine project feasibility and cost effectiveness to

implement changes through which PFK (2010) can benefit in effectiveness. Furthermore, adding to the bottom line results, as Orion (2011: 1) believes that if manufacturers start moving their IT priorities from the back office (ERP) towards the factory floor (MES), for real time manufacturing intelligence, they will create a higher return in business value.

A further recommendation is for PFK management to put strategic plans in place, including the use of the EFQM model (2010), to bridge the gap between all levels of management and union members, as the research has shown two differing cultures. The best means of improving communication and building relationships is as Deaux *et al.* (1993) explain - it is to find common ground.

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