Measuring and analysing internal and external customer satisfaction in a multidisciplinary engineering company

by

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Executive Summary

Powertech System Integrators (Pty) Ltd (PTSI) is a multidisciplinary engineering company serving the electrical, utilities and information technology industries in Africa. They are based in Pretoria, South Africa and have a footprint across Southern Africa. PTSI consists of four Lines of Business (LoB's) which provide solutions to their clients independently from each other. The clients of PTSI include utilities, metropolitan cities, municipalities, mines, chemical plants, substations, telecommunication companies and other consulting engineering companies. PTSI's employees are as diverse as its clients and make for complex interactions between them and the clients.

A common factor between the clients and the employees is the Customer Support Centre (CSC), which is responsible for the reception function to the business as well as selected first-tier support to two of the LoB's. The CSC plays a vital role in the image of PTSI to clients and should ensure that it is effective. In essence, the CSC serves both clients and employees as external and internal customers.

The goal of this project was to develop a uniform customer feedback tool for both EXTERNAL CUSTOMERS and INTERNAL CUSTOMERS of PTSI to feed into a newly developed performance measurement system in order to determine the effectiveness and productivity of the CSC with regard to Customer Satisfaction (CS).

Surveys were thoughtfully designed and utilised as customer feedback tools. The outputs of the surveys were used as inputs for statistical models to process the data in a way that could be used for reporting on the performance of the CSC. The additional services provided by the CSC were also included as inputs to the overall Performance Measurement (PM) system of the CSC as a business function.

The PM system was designed to link with the business strategy for the identification of goals and objectives for the CSC, to ultimately assist in growing the business. Traditional Key Performance Indicators (KPI's) were incorporated with custom PTSI KPI's to tailor-make the solution for the CSC.

The outputs of the models are presented in visual format, on a dashboard, to make them more understandable and thus easier to report on. The ease of use also improves the decision makers' processes.

The CSC can determine which areas of the business function needs the most attention when dissatisfaction is encountered and it can segment customers in such a way that strategies can be created to improve those customers' experiences of the interactions they have with the CSC.

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Acronyms and abbreviations

PTSI	Powertech System Integrators (Pty) Ltd
CSC	Customer Support Centre
LoB	Line of Business
EIS	Engineering Information Systems
EM	Energy Management
IPP	Industrial Plant Projects
PIM	Power Infrastructure Management
SHERQ	Safety, Health, Environmental, Risk and Quality
CS	Customer Satisfaction
NPS	Net Promoter Score
CES	Customer Effort Score
ACSI	American Customer Satisfaction Index
CSAT	Customer Satisfaction
ECEF	Enhanced Customer Experience Framework
CRM	Customer Relationship Management
PBX	Private Branch Exchange
PM	Performance Measurement
KPI	Key Performance Indicator
TTR	Time-to-Resolution
RR	Response Rate
TV	Target Value
USL	Upper Specification Limit
LSL	Lower Specification Limit

Chapter 1

Introduction

Powertech System Integrators (Pty) Ltd (PTSI) is a multidisciplinary engineering company focused on solutions in the electrical, utilities and information technology industries in Africa. They are based in Pretoria, South Africa with satellite bases in Port Elizabeth, Durban and Cape Town, South Africa, with recent expansion to Nairobi, Kenya.

1.1 The business

PTSI consists of four Lines of Business (LoB's) namely:

- Engineering Information Systems (EIS);
- Energy Management (EM);
- Industrial Plant Projects (IPP) and
- Power Infrastructure Management (PIM).

The LoB's provide solutions to their clients independently from one another. Each LoB has its own supporting services such as project management, but do, however, share some services such as administration, financing and business development.

The EIS business provides software solutions that enable clients to manage assets and work activities, enhance service delivery and reduce operating costs. The four main areas of expertise in the EIS business are Enterprise Asset Management (EAM), Geographic Information Systems (GIS), mobile workforce applications and Advanced Distribution Management Systems (ADMS). Their customers include municipalities; state-owned enterprises, such as Telkom and Eskom; private businesses, such as Netstar; and non-profit organisations such as the Automobile Association of South Africa (AA). The business builds on domain knowledge, engineering capabilities and a deep understanding of customer requirements to provide consulting, turnkey and managed services that are tailor-made for the client.

EM mainly assists South Africa's electricity provider, Eskom, with solutions to improve billing accuracy and to reduce non-technical losses. The business is active in different market sectors to assist the large power user clients to find innovative and sustainable ways of managing and reducing energy consumption. An in-house software product, ecWIN^{TM}, is used with Enermax meters, load

control units, proven communication technology and third party metering products for Automated Meter Reading (AMR) solutions.

IPP is a multidisciplinary engineering, project and construction management service on either an EPC/Turnkey or EPCM basis. The business's capabilities include technology evaluations and feasibility studies. IPP's in-house engineering expertise includes process, mechanical, electrical, and control and instrumentation disciplines. A drawing office with 3D modelling capabilities is another offered service. Projects in off-gas filtration, flue gas cleaning as well as co-generation and standby power are currently in various stages of the project life-cycle. Clients of the IPP business stretch over many market sectors and include power generation companies, mining companies, utilities and other engineering companies.

The PIM business is the largest LoB of the four and their work is about ensuring an uninterrupted flow of electrical energy. PIM builds and provides solutions that use world-class protection and control systems, connector systems, surge arrestors and surge protection devices for underground cables and overhead line networks. Some PIM solutions include substation automation and protection schemes, distribution network upgrades, direct current auxiliary power systems and transformer monitoring and diagnostics. The clients serviced by PIM include Sasol, Eskom, City Power, Electricidade de Mocambique and Umeme in Uganda.

PTSI also provides product-specific and solution-based training courses for engineers, technicians, electricians and cable joiners.

In summary, PTSI provides a vast array of services and expertise, which adds significant complexity to the business as a whole.

1.2 The people

PTSI's employees consist of engineers from various disciplines, such as electrical, electronic, mechanical and process engineering, as well as software developers, technicians, draughtsmen, sales representatives, project managers and financial and administration personnel. Some employees have more than 20 years' experience in their respective fields of expertise and can be defined as subject matter experts. The business has a diverse body of highly qualified resources with long-standing relationships with their clients, which makes PTSI an attractive choice when it comes to engineering solutions in the electrical engineering space.

1.3 The customers

Table 1.1 contains PTSI's typical customers, their requirements and the interactions the different LoB's encounter in their fields of expertise.

Table 1.1: **Client Interaction Table**

PTSI Line of Business	Typical Clients	Typical Requirements from Clients	Typical Interactions with those Clients
EIS	- Metropolitan cities and municipalities - Utilities (Water, power and telecoms) - Mines - Telecommunication companies - State-owned enterprises - Privately owned companies such as sugar mills, cement factories and food producers	- Enterprise asset management - Workforce management relating to scheduling and mobility - Geographic information solutions relating to data and spatial analysis and other modelling - Distribution automation solutions to increase reliability and quality of service - Decreasing of outage by monitoring and control solutions - Training	Initial interaction with an identified client starts with the generation of the actual problem definition as perceived by the client. From there requirements analysis and definition is completed and solution design follows. After the solution is developed it gets implemented. The Customer Support Centre comes into play when a Support and Maintenance contract is concluded. The clients contact PTSI relating to their specific solutions and predefined processes are then followed to resolve various requests. Some of the enquiries are handled by first-tier support functions within the CSC and the other enquiries are handled by technical experts within the LoB. The CSC agents have the know-how to identify the appropriate technical expert to transfer a call- or email enquiry to. **In the EIS LoB there are hardware and software support protocols in place that include hardware swops and software patches. These support functions distinguish the EIS LoB from the other LoB's.**
EM	- Municipalities (Local and African Municipalities) - Utilities (Eskom and other African countries' utilities) - Other consulting engineering companies - Mining companies - Industrial applications companies	- Cost reduction of electricity expenditures - Revenue protection through accurate billing and billing verification processes - Prevention of non-technical electricity losses - Reduction of the need for manual readers by using Automated Meter Reading solutions - Real-time metering and monitoring solutions for electricity production and consumption - Power factor corrections and energy efficiency metering and monitoring - Demand site management by scheduling and load shifting solutions - Training	Initial interaction with an identified client starts with the generation of the actual problem definition as perceived by the client. From there requirements analysis and definition is completed and solution design follows. After the solution is developed it gets implemented. The Customer Support Centre comes into play when a Support and Maintenance contract is concluded. The clients contact PTSI relating to their specific solutions and predefined processes are then followed to resolve various requests. Some of the enquiries are handled by first-tier support functions within the CSC and the other enquiries are handled by technical experts within the LoB. The CSC agents have the know-how to identify the appropriate technical expert to transfer a call or email enquiry to.
IPP	- Utilities (Power and water) - Mines - Chemical plants	- Energy recovery - Gas cleaning solutions - Water treatment and recovery solutions - Alternative and renewable energy solutions - Process control, workflow and analytics regarding gas, power and water usages - Automation control systems	The IPP LoB provides solutions that have a very long life cycle and as a result the engineers have direct contact with the clients for 95% of the time. The projects follow the same life cycle as the EM and EIS LoB's, with the exception of the after-sales support.
PIM	- Utilities (Power and water) - Owners of substations - Metropolitan cities and municipalities - Contractors tasked with building substations	- Protection schemes - Control schemes - Implementation of their products in protection, automation and control schemes - Sales of the loose products being used in their schemes for maintenance - Training	The PIM LoB projects follow the same project life cycle as the EIS and EM LoB's, but they do provide on-site technical support that the other LoB's don't provide.

The current operations within PTSI can also be described as complex because of the diverse employees, projects and customers. More complexity is introduced by all the different measures of success, Key Performance Indicators (KPI's) and metrics. If an overall metric were to be used for PTSI it would have to be standardised across all the LoB's.

1.4 The changing environment

PTSI has undergone extensive organisational changes from 2014 to 2016, which have influenced their employees' work environment and clients' experiences significantly. These changes include the implementation of a manufacturing SAP environment as an Enterprise Resource Planning (ERP) system, two restructuring processes of the organisational structure, a retrenchment process and the implementation of a Software-as-a-Service Customer Relationship Management (CRM) system. The changes have necessitated the redefinition of the strategic business goals.

When defining the strategic business goals, the complex operating environment of PTSI along with its stakeholder views was considered and five influencing factors were identified in the operating space. The five influencing factors are as follows:

- Urbanisation;
- The Future of Power;
- Infrastructure Development;
- Connectivity and Convergence; and
- New Business Models.

These factors all influence the views of PTSI's stakeholders. The stakeholders are the shareholders, employees, partners, competitors and clients. For this project the two most important stakeholder views, in conjunction with the influencing factors, are the views from the clients' and employees' perspectives.

Singh (2006) states that Customer Satisfaction (CS) has a positive effect on an organisation's customer loyalty and retention and Martin (2010) proves that an increase in shareholder value is a definite by-product of the focus on CS.

The clients of PTSI are expecting world-class technologies and products supported by unique core competencies and subject matter experts that consistently provide value for money. Customers further have an expectation that the subject matter experts are responsive, flexible and innovative in dealing with the complexities they face when encountering a problem.

In order to assist in the clients' perspective, an initiative was started to capture all incoming communications from external clients at one entrance point to the business. For this function, the existing call centre of the EIS business was upgraded to a Customer Support Centre (CSC). The main function of the agents in the CSC is to capture incoming calls and emails relating to the business and to provide first tier support for the cases they are qualified to resolve. The cases they are not qualified to resolve are transferred to the relevant internal contact person in each of the LoB's, also referred to as the Internal Receiver. Another function of the agents in the CSC is to support the implemented

solutions of the EIS and EM businesses. The agents resolve mobile workforce requests, related to hand-held devices, and remotely monitor ecWin^{TM}systems to check them for faults.

From the employees' perspective, PTSI is expected to create a space with the freedom and trust for innovation to happen and to be able to become experts in their respective fields. A sense of pride and loyalty is appreciated from management to the employees, in order for them to be the best people in the market in what they do.

The CSC is in direct contact with both the business's clients and its employees. Thus, the CSC is a very important aspect of PTSI's clients' experience of the business and its services.

1.5 Measuring the customer satisfaction

Figure 1.1 is a visual representation of the current CS measuring method in PTSI. For the sake of simplicity, the clients of PTSI will be referred to from here as EXTERNAL CUSTOMERS and the employees of PTSI will be referred to as INTERNAL CUSTOMERS.

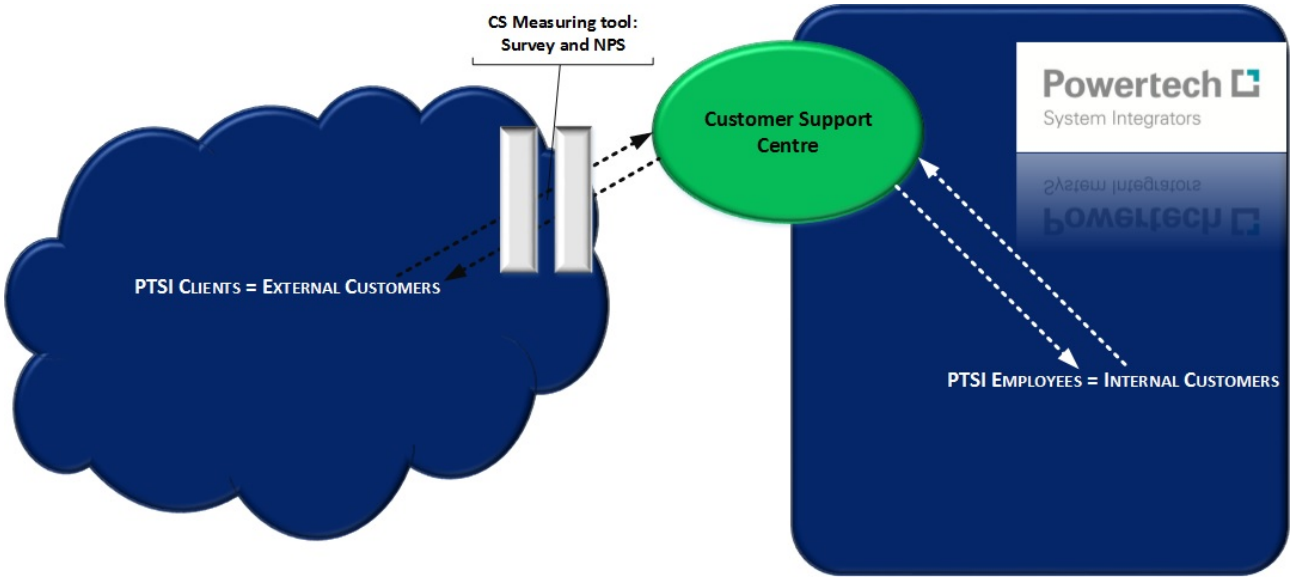


Figure 1.1: **As-Is scenario of CS measuring in PTSI**

In order for PTSI to gauge the likelihood that a client will recommend the business's engineering services to their contacts, which in turn expresses the loyalty and satisfaction of the clients, the Net Promoter Score (NPS) is currently being used. This is presented in Figure 1.2.

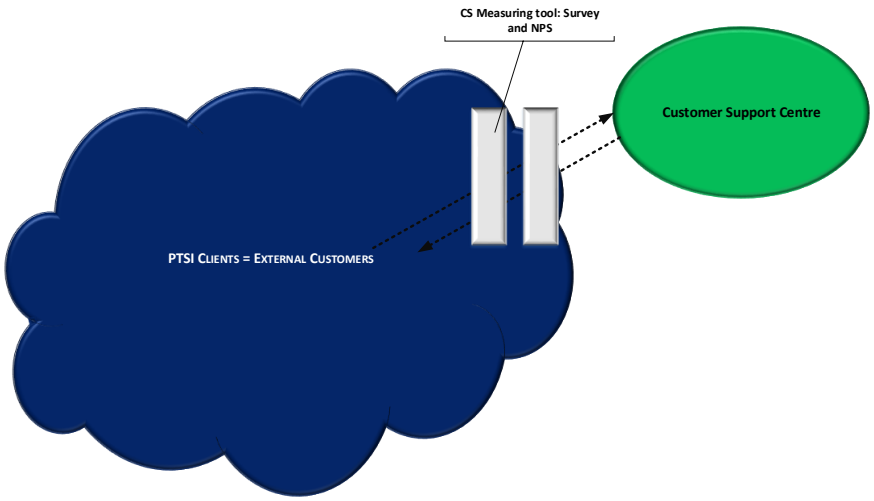


Figure 1.2: **External CS measuring currently done by PTSI**

The NPS was first suggested by Frederick F. Reichheld in his 2003 Harvard Business Review article, *The One Number You Need To Grow*, where he stated that the loyalty of a business's clients can be determined by substituting the complex satisfaction questionnaires with one single question. By using this single question businesses could put results to use and direct employees on the task of growing the business (Reichheld, 2003). The single, most effective question that Reichheld identified was "*How likely is it that you would recommend [company A] to a friend or colleague?*" and the question would then be answered by the client on a scale of 0 to 10, where 0 is not at all likely and 10 would be very likely. The scale is divided into three classes:

- A score of 0-6 would make the client a detractor - a person who disparages someone or something;
- A score of 7-8 would make the client passively satisfied - neutral; and
- A score of 9-10 would make the client a promoter - a supporter of a cause or aim.

After the scores of all the surveyed clients are processed into percentages the NPS is then calculated by subtracting the percentage detractors from the percentage promoters.

$$NPS = [\frac{x}{N} \times 100] - [\frac{y}{N} \times 100] \tag{1.1}$$

Where:
N = Total number of responses;
x = Number of promoters and
y = Number of detractors.

The NPS is currently being used in PTSI as a management and decision-making tool on a transactional basis. Surveys are being completed by customer support agents, in the CSC, by contacting

clients by telephone and asking them to answer the survey questions after the conclusion of an engineering project. These surveys are then processed by the Safety, Health, Environmental, Risk and Quality (SHERQ) department and a NPS is calculated. The surveys, however, consist of multiple questions, with the important single question suggested by Reichheld being one of these. This is a time consuming and frustrating process to the clients and the agents. Only the results of the NPS portion of the surveys are processed and reported back to management on a regular basis, which means that only a partial view of the customers' views are reported on and available for strategic planning activities.

Currently, the interactions between the CSC and the INTERNAL CUSTOMERS include transferring incoming telephone calls and taking messages if the INTERNAL CUSTOMER is not available. An automated process, managed by the CRM system, has been implemented to streamline the message-taking actions. The CSC also monitors a mailbox dedicated to customer support-related enquiries and they reroute the emails to the relevant people when the emails are received. The efficiency and effectiveness of the interactions are currently not being measured and as a result, a picture of the satisfaction of the customers is not available as shown in Figure 1.3.

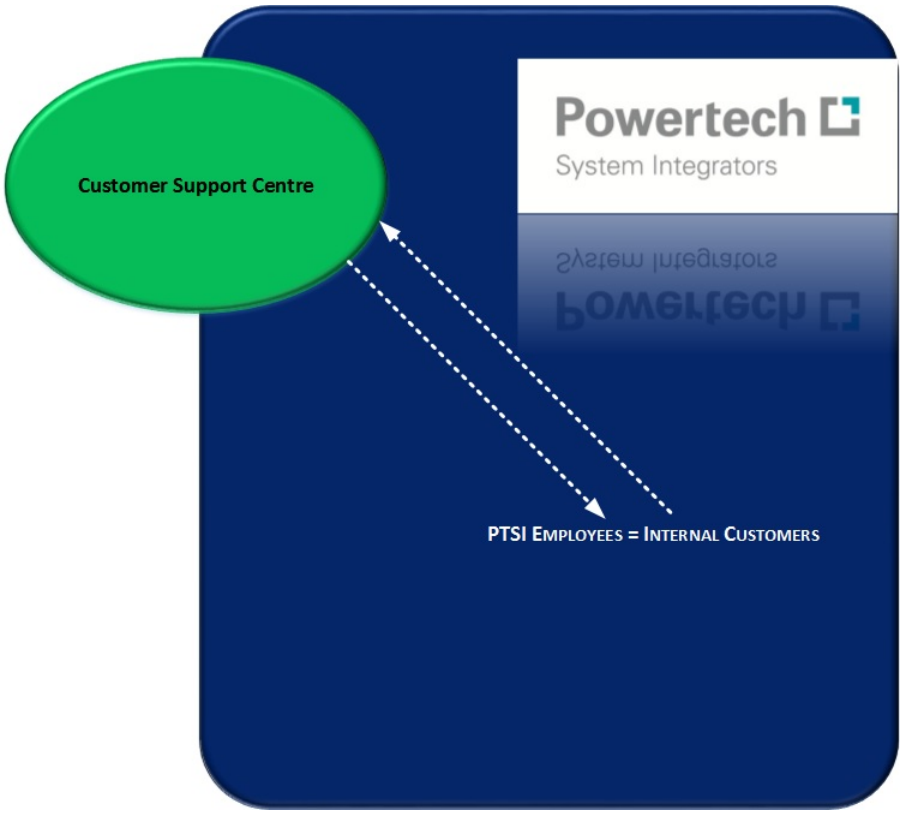


Figure 1.3: **Internal CS with the services of the CSC, which is currently absent from PTSI**

1.6 Problem investigation and definition

At a reporting meeting held on 26 November 2015 the transactional NPS, measured and processed by the SHERQ department, was equal to zero. This means that the percentage of PTSI's detractors is so great that it completely cancels out the percentage of its promoters. In other words, there are a

lot more customers that would not recommend PTSI's engineering services to others than customers that would recommend the services.

It is unclear which EXTERNAL CUSTOMERS make up the detractors and which make up the promoters. This prevents the use of customer segmentation methods to address the dissatisfaction of the detractors and leveraging the promoters' most appreciated aspects of the business.

This measurement is a reflection of the opinions of PTSI's EXTERNAL CUSTOMERS alone and no official feedback or opinions are available from the INTERNAL CUSTOMERS.

Seeing as the CSC has also become a prominent aspect of PTSI's image to its EXTERNAL CUSTOMERS and must perform a vital communications-and-support function to its INTERNAL CUSTOMERS, it has become necessary to measure the performance of the CSC from both sides. Currently no uniform measurements for the CS or performance of the CSC are available.

The absence of measurements is troublesome, because valuable improvement opportunities can not be identified if the current performance of a business function is unknown. In order to rectify this, measurement systems and capacities should be put in place for measuring the current performance. When the current performance can be measured accurately, only then can targets be set and the improvement opportunities be identified to close the gap between the current performance and the target performance, as conceptually shown in Figure 1.4. Without setting targets, a business will also not be aware of the problems it really has to solve to reach those targets.

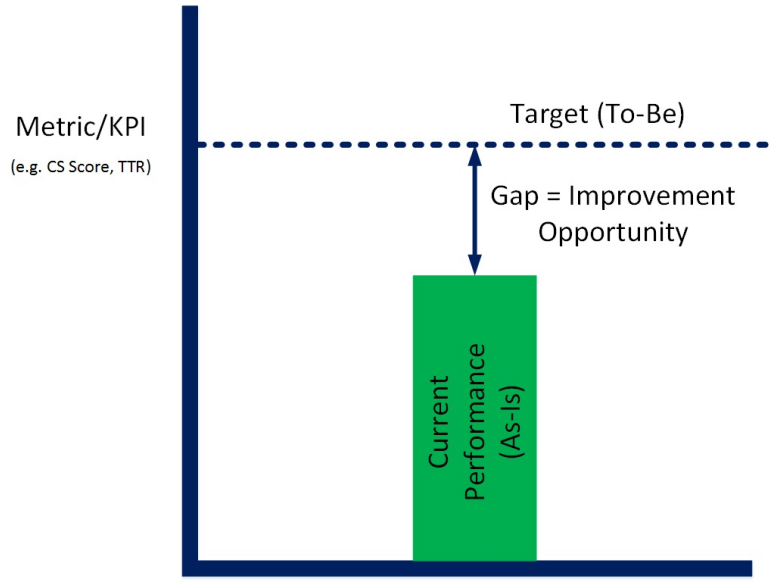


Figure 1.4: **Conceptual representation of the identification of improvement opportunities**

The business problems identified can be combined to produce the following descriptive problem statement:

A uniform customer feedback tool, for both EXTERNAL CUSTOMERS *and* INTERNAL CUSTOMERS *of PTSI, is needed to facilitate the development of a performance measurement system to determine the effectiveness and productivity of the CSC with regard to Customer Satisfaction.*

According to Stroud (2011), a business requirement can be defined as critical activities of a business that must be performed to meet the organisational objectives. The business requirements must be

defined independently from the solution. The problem statement stated above can thus be defined as a business requirement of PTSI that needs to be addressed in order to achieve the strategic goals referred to in Section 1.4.

1.7 Possible solution

Figure 1.5 is a visual representation of a possible solution to the stated problem.

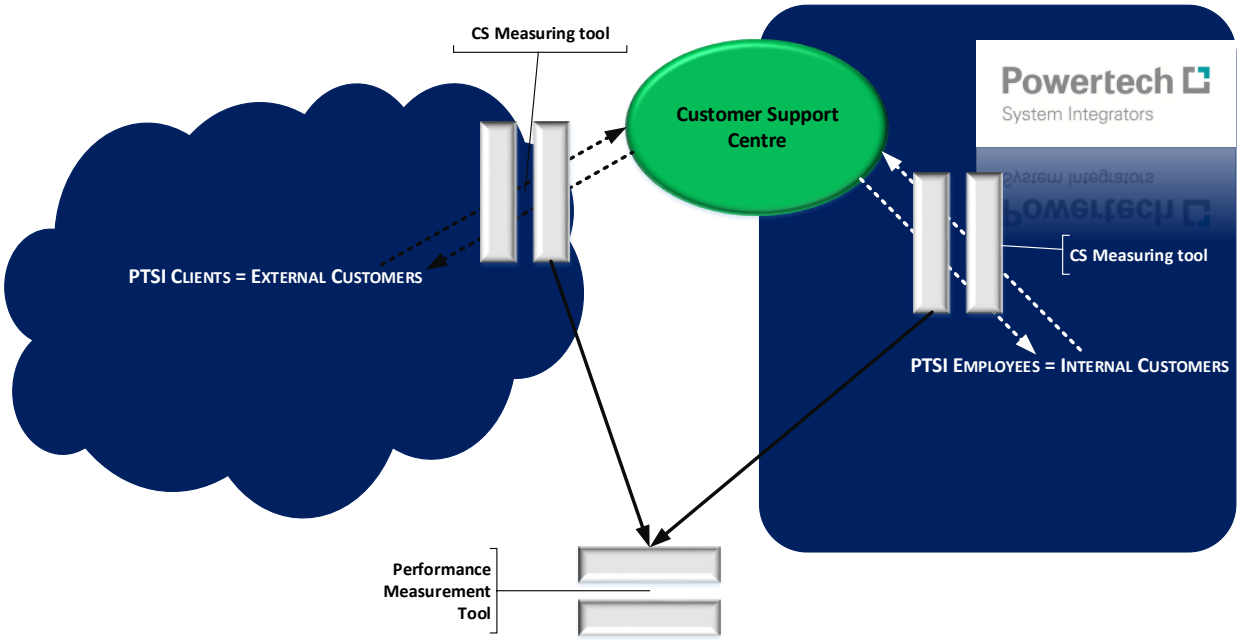


Figure 1.5: **To-Be scenario of CS measuring in PTSI**

The purpose of solution requirements is to give a detailed view of what a solution must include in order to solve a problem and reach a goal or objective. The problem defined in the previous section is considered as the goal that must be achieved.

The solution requirements are:

1. Define the current communicative interactions between EXTERNAL CUSTOMERS and the CSC and INTERNAL CUSTOMERS and the CSC
2. Determine and state the most appropriate approach to customer feedback tools for both EXTERNAL CUSTOMERS and INTERNAL CUSTOMERS
3. Identified feedback tools must be simple, descriptive, cost-effective, time-saving and statistically significant

4. The resulting design of the identified customer feedback tools should conform to the above-mentioned attributes
5. A mathematical model is required to capture and interpret the results of the feedback tools
6. The significance of the customer feedback tools in the measuring of performance of the CSC must be determined and stated
7. An appropriate performance measurement tool for the CSC must be identified, stated and designed
8. The identified performance measurement tool must effectively and accurately use the outputs of the customer feedback tools as inputs
9. The designed tools and models must be made available in a program that is familiar to the end users
10. All the designed tools should be able to stand up to a validation exercise to prove the relevance and effectiveness of the solution

1.8 Project aim and approach

The aim of this project is to solve the stated problem by addressing every solution requirement listed above. The approach to the development of the solution will be started by conducting the necessary research into the customer feedback tools, the performance measurement tool and the statistics to effectively measure the outputs of the tools. From the critically reviewed literature, designs of the tools will then be presented in a visual format and the data surrounding the tools will be presented in the format of mathematical models.

1.9 Project scope and deliverables

The scope of the project is of an experimental nature and the deliverables of the project are as follows:

- A visual design of a customer feedback tool for EXTERNAL CUSTOMERS dubbed the EXTERNAL CUSTOMER FEEDBACK TOOL;
- A mathematical model for the results of the EXTERNAL CUSTOMER FEEDBACK TOOL;
- A visual design of a customer feedback tool for INTERNAL CUSTOMERS dubbed the INTERNAL CUSTOMER FEEDBACK TOOL;
- A mathematical model for the results of the INTERNAL CUSTOMER FEEDBACK TOOL;
- A visual design of a performance measurement tool to measure the performance of the CSC; and
- A document that includes the stated deliverables.

1.10 Document structure

The last deliverable, the document, will have the following structure:

- **Chapter 1 Introduction**: Setting the context for the project and stating the problem to be solved;
- **Chapter 2 Literature review**: Reviewing the available literature in terms of the requirements to determine the appropriate solution methodology;
- **Chapter 3 Conceptual design and design specifications**: Describing and explaining how the solution will meet the requirements;
- **Chapter 4 Solution design**: Refining and creating designs and models. Analysis of outputs of designs and models; and
- **Chapter 5 Results, interpretations and solution validation**: Interpretations of the results and validation of the solution.
- **Chapter 6 Conclusion**: Drawing of conclusions from the results of the analyses and recommending potential future work.

Chapter 2

Literature review

In this chapter, literature is critically reviewed to determine how customer feedback is collected, measured and analysed to calculate applicable Customer Satisfaction (CS) scores. Further literature regarding Performance Measurement (PM) systems is reviewed to determine how such a system should be designed for the output to be of value to the business.

2.1 Approaches to customer feedback

2.1.1 External customer satisfaction

Customers in the current business environment can choose from a wide variety of available products and services, which causes businesses to place a heavy focus on customer retention. To keep a customer and to enjoy the profitability that comes with customer loyalty, businesses need to make CS a central concern of management (Botha et al., 2012).

Various metrics have been developed in the last two decades to measure external CS and predict customer loyalty. Four of the most popular methodologies are the Net Promoter Score (NPS), Customer Effort Score (CES), American Customer Satisfaction Index (ACSI) and the Customer Satisfaction (CSAT) metric (Benjamin, 2015). Table 2.1 contains the different attributes of the four methodologies.

Table 2.1: **Attributes of CS measuring methodologies (Benjamin, 2015)**

Methodology	Origin	Rationale	Questions	Scaling	Extra
Net Promoter Score (NPS)	Developed in 2003 by Frederick Reichheld.	Rides on the thinking that the more satisfied a customer is, the more likely he/she would be to promote the business and return.	Single question: "How likely are you to recommend our service to you colleagues and friends?"	A scale of 0-10 is used where 0 is least likely and 10 is extremely likely. The scale is broken up into three categories to classify the type of loyalty a customer has towards the business. Basic calculations are done to determine the NPS.	
Customer Effort Score (CES)	Introduced in 2010 by the Customer Contact Council (CCC).	Rides on the thinking that the less effort a customer has to expend to get a request resolved, the more satisfied he/she would be.	Single question: "How much effort did you personally have to expend to have your request resolved?"	The scale is broken up into Very Low Effort, Low Effort, Neutral, High Effort and Very High Effort.	Can't be considered as a direct measurement of customer satisfaction, but the CCC claims that customer effort and customer loyalty are strongly correlated.
American Customer Satisfaction Index (ACSI)	Developed and introduced in 1994 by the University of Michigan.	Primarily measures the customer satisfaction across the US economy, but has been expanded for use in the commercial space.	Three questions: "What is your overall satisfaction with our service?", "To what extend has our service met your expectations?", "How well did our service compare to what you would consider the ideal offering?"	Up to the surveyor's discretion – scales or descriptive answers.	Since the ACSI's introduction it has been expanded into a model that can be used to approach the complete concept of customer satisfaction in a business.
Customer Satisfaction (CSAT)	Unclear.	Asks directly if the customer is satisfied.	Single question: "How would you rate your overall satisfaction with our service?"	Expressed in a percentage from 0-100% where 100% represents 100% satisfied.	Less popular than the other methods.

Botha et al. (2012) have developed a CS framework, called the Enhanced Customer Experience Framework (ECEF), by combining Business Process Re-engineering, Quality Function Deployment (QFD) and simulation. The ECEF is a framework used for enhancing the customer experience through the use of improved business processes. Surveys and interviews are also used to gather customer data and requirements to enable the QFD to relate them to the customer-based business processes in need of improvement.

Stelzer et al. (2015) evaluate the need for standardised automated information exchange to improve the service quality of a public transportation company. The information exchange that was focused on, was between the travellers and the company, where the needs and expectations of both parties were defined by firstly using surveys before proposing a bidirectional information and communication system. The system did not only improve the company's ability to improve customer service but also improved dispatch times that have an indirect connection to CS.

Surveys are an integral part of all the approaches described. They are mainly used to collect customer feedback directly. This is beneficial when measuring external CS because the surveys provide an opportunity to measure the customers' satisfaction by directly finding out from them how satisfied they are and why (Brogle, 2014).

2.1.2 Internal customer satisfaction

Miller (2012) defines internal customer service as the service that is provided to departments and colleagues within a business, for employees to get their work done. If employees are able to get their work done satisfactorily and in alignment with the strategies of the business, they become more efficient at dealing with external customers' requests. This relationship was first identified by Berry (1981) in the retail banking space. Furthermore, Gilbert (2000) states that each internal system should also be aligned to the strategies of the business and add value to other systems, as though the others were its customers. The service-profit chain, by Loveman (1998) (Figure 2.1), is a visual representation of the relationships between the business's internal systems that lead to loyal and satisfied employees.

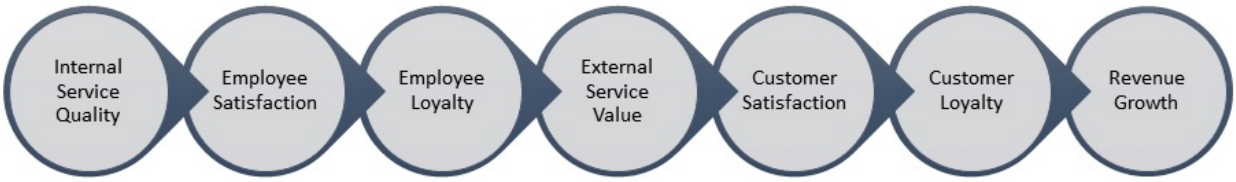


Figure 2.1: **The service profit chain**

From his work with different focal groups from different industries, Gilbert (2000) identifies two generic measures to assess internal CS, namely personal service and technical competence. Surveys were used to ask the focal groups to estimate how their internal customers would rate them and their perceptions were skewed. He noted that individuals tend to assume that their own work units' internal services are acceptable, but that in reality they are not delivering the needed services to their internal

customers and causing breaks in the service-profit chain as a result. Thus, it is possible to measure internal CS with surveys, but self-rating surveys are subject to biases and "self-serving perceptual distortion".

Rust et al. (1996) developed a framework for understanding employee satisfaction by using a CS approach. They conclude that a survey about the average intention to remain employed can be used to identify the changes needed by management to drive internal CS.

2.2 Designing customer feedback tools

2.2.1 Considerations when designing customer feedback tools

Biases and limitations should be kept in mind when designing surveys to be used for customer feedback because they might prevent the drawing of sound conclusions from the data. Issues that are often encountered with surveys are various types of biases, such as regional biases, the absence of statistical significance and the different ways that people can interpret the scales on the surveys. Stroud (2010b) has identified nine steps to create good customer surveys while keeping the biases and limitations in mind. They follow in Figure 2.2.

2.2.2 Ethics

The University of Portsmouth (2013) states that not all surveys need to be reviewed by a research ethics committee. The underlying intention of the evaluation determines whether a survey needs to be reviewed. The evaluation of a service or a product without any experimentation does not need an ethics review.

The participants' consent is required if the survey is of a sensitive nature, and if the survey is completed anonymously then written consent will not be needed. Participants should, however, be adequately informed about the research being conducted.

2.2.3 Analysing and interpreting the results of customer surveys

The data collected from the surveys have to be meaningful and presented in a way that will be of use to the decision makers of a business. Another reason for the careful selection of data presentation is that the analysis thereof will be easier. The chosen method of analysing the survey results should, very importantly, account for statistical significance to ensure that decisions can't be based on random chance (Brogle, 2014).

Aydin et al. (2015) created a hierarchical CS framework to evaluate the CS levels of the very complex public rail transit systems in Istanbul. The framework was created by integrating statistical analysis, a fuzzy analytic hierarchy process (FAHP) and the fuzzy-Choquet integral. All based on surveys conducted in the city.

2.3 Performance Measurement (PM) systems for call centres

In their book, *Customer Satisfaction Measurement for ISO 9001:2000*, Hill et al. (2002) explain the theory and practicalities of statistical analysis and sampling to ensure the production of accurate

measures in Customer Satisfaction (CS) measurement activities. These practicalities, related directly to Section 8 of ISO 9001:2000, relate statistical analysis to PM from a quality assurance perspective.

2.3.1 Key Performance Indicators (KPI's) for call centres

Dixon et al. (2010) directly tie the Customer Effort Score (CES) to call centres in his Harvard Business Review article, *Stop Trying to Delight Your Customers*, and stated that the necessity for repeat contact by a customer to resolve his/her request definitely undermines the customer's loyalty to the business. In a case study, conducted by Stroud (2010a), he found that applying Six Sigma improvement processes to a call centre was beneficial because through the voice-of-the-customer the most important requirement is issue resolution time, also known as Time-to-Resolution (TTR). The shorter the TTR became, the higher the CS rose. Other metrics such as call quality, skill levels, average call duration and first call resolution should also be mentioned as they form part of the most common call centre metrics.

2.3.2 Designing a PM system

A PM system is a dynamic and balanced system that is able to support a business's decision-making process by gathering and analysing information regarding its employees' performance (Garengo et al., 2005). Hudson et al. (2001) studied various PM system approaches to formulating a theoretical model of the strategic PM development process. This model states that a strategic PM system should be designed to be:

- Derived from the business strategy;
- Designed for an explicit purpose and clearly defined;
- Relevant;
- Easy to understand, use and maintain;
- Able to provide accurate feedback;
- Stimulating continuous improvement and
- Linking operations to the business strategy.

The model also identifies specific metrics that the strategic PM system should be designed to measure, namely:

- Quality;
- Time;
- Customer satisfaction;
- Flexibility;
- Human resources and
- Finances.

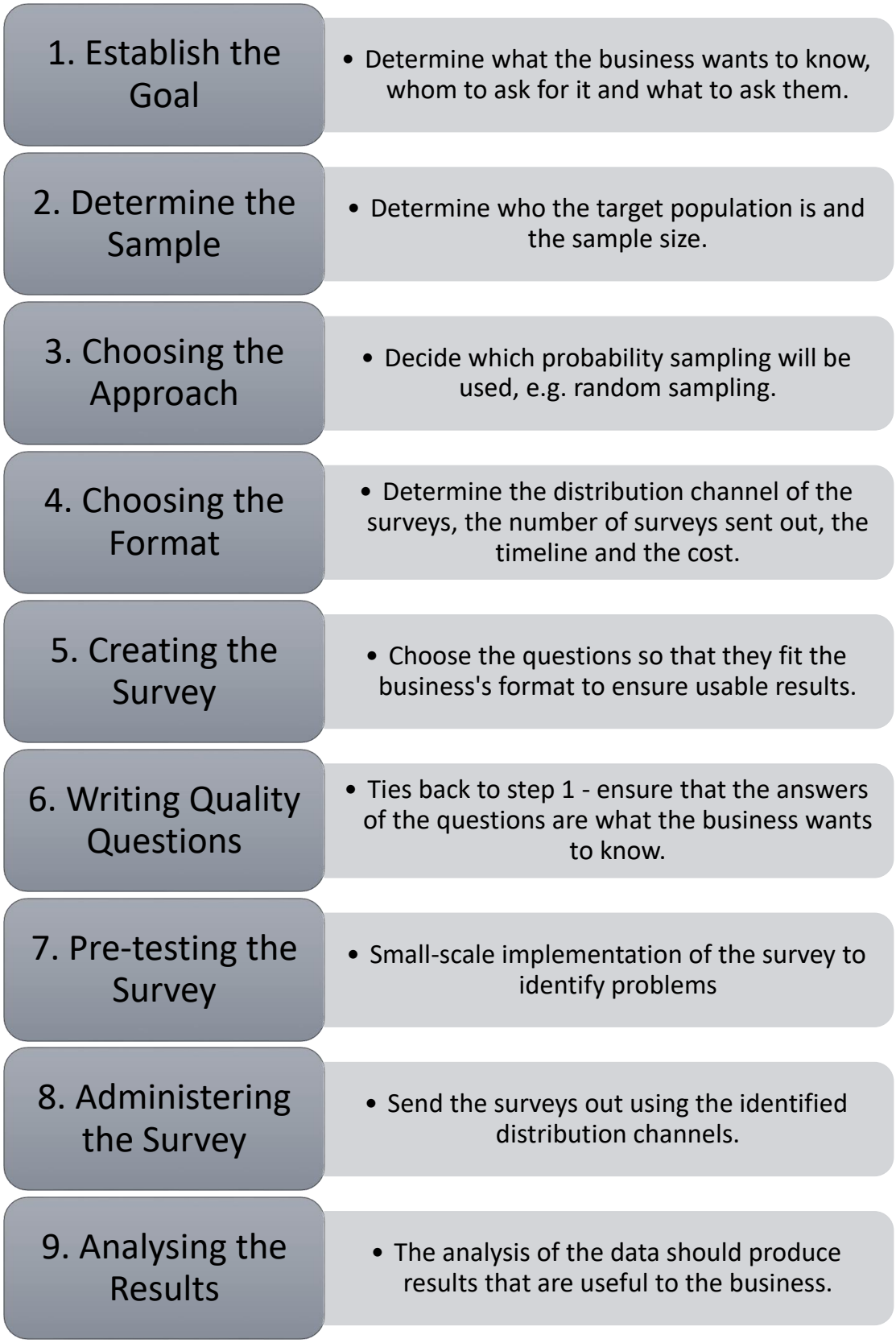


Figure 2.2: **The nine steps to design a survey**

2.4 Quality engineering and statistical quality control

Quality engineering is a set of activities (engineering, managerial and operational) used to ensure that the characteristics of a product or service are at the required levels and that the variability around the desired levels is minimised (Montgomery, 2013).

Statistical quality control is used to describe a set of tools that are used by quality professionals to describe the variability that occurs in the production process. The toolset is based on statistics. Statistical quality control consists of three categories that are needed to measure and evaluate the quality of services or products (Reid and Sanders, 2011).

1. Descriptive statistics: Descriptions of quality characteristics and relationships such as the range, distribution, mean and standard deviation of data.

2. Statistical process control: Inspection of an output, chosen via random sampling, to determine if a process is producing outputs with the characteristics that fall within a predetermined range. Used to determine if a process is functioning as it should.

3. Acceptance sampling: Random inspection of samples in order to determine whether a complete lot should be accepted based on the results.

The use of statistical quality control tools in service organisations has lagged behind manufacturing organisations, because of the intangibility of the services. A way around this is to identify important metrics of a service and then define quantifiable measurements for the metrics. An example of this would be the number of customer complaints that have been received over a specified time (Reid and Sanders, 2011).

Statistical process control utilises the descriptive statistics to monitor the quality of a process and the output it produces. A chart is used for the monitoring of the process by illustrating variation that is normal. In other words, the chart shows whether the chosen sample of data points falls within the normal range of variation. Limits on the chart are used to separate normal from assignable causes of variation. If any of the data fall outside of the limits then the process is said to be out of control as shown in Figure 2.3 (Reid and Sanders, 2011).

Quality characteristics can be evaluated respective to specifications. These specifications are the desired measurements for the characteristics that make up every part of the product or service including the final result. A measurement that links to the desired value for the quality characteristic is the Target Value (TV) or nominal value. A range of values, believed to be sufficiently close to the TV, bind the TV of a specific quality characteristic. The largest acceptable value of the range is called the Upper Specification Limit (USL) and the smallest acceptable value is called the Lower Specification Limit (LSL) (Montgomery, 2013).

Figure 2.3: **Control charts: In control and out of control (Simon, 2002)**

Specification limits can be one-sided or two-sided. The two scenarios relating to one-sided limits are *the-Higher-the-Better* and *the-Lower-the-Better* and the scenario related to two-sided limits is *Nominal-the-Best*. The one-sided scenarios have a single specification limit below or above the TV because the other specification limit can be deemed irrelevant (Montgomery, 2013). An example of a *the-Lower-the-Better* limit is the pollution level of a body of water where a USL implies that the water pollution is not allowed to ever surpass a certain level, but should the level be much lower than the TV it wouldn't be of too much negative consequence.

2.5 Literature review conclusion

From the literature reviewed it can be established that it is possible to solve the stated problem and that the solution requirements can be addressed with a combination of current tools and techniques available.

The literature showed that surveys can and are used to collect both INTERNAL AND EXTERNAL CUSTOMER feedback and that if the uniqueness of a business is kept in mind in the design of those surveys, they can provide valuable information for the business. The collection of data regarding products or services also does not require ethical review. When the measurements and analyses of the feedback are done by means of statistical analysis, random chance decision-making can be prevented and valuable results can be available to the business. The results of the statistical analysis can also be displayed in a clear and understandable manner by using the concepts of control charts. The interpretation of the results will be easier if they are represented this way.

The CS score, obtained from the analysis, was identified as one of the important metrics needed to measure the performance of a call centre. This ties the solution requirements together to form the concept of an appropriate solution with interdependent aspects that can address the identified

business requirement. In other words, the CS metric of a strategic PM system requires the output of a customer feedback tool as an input, for the measurement of a call centre's performance.

The design approach of the solution must then focus clearly on the interdependence of the different aspects to ensure they function in harmony and complement one another.

Chapter 3

Conceptual design and design specifications

This chapter contains the concepts followed to reach a stage where the solution for the problem stated in Chapter 1, can be designed in detail. As a precursor for the solution design, this chapter contains the concepts required for the solution to effectively address the solution requirements. The next chapter contains the final data preparation and development of the models. Finally, the results from the designed solution are interpreted and the solution is validated. Figure 3.1 illustrates that the concepts explained in this chapter play a fundamental role in the complete solution design. Alternatively stated, the solution can not be effectively designed or developed without these concepts.

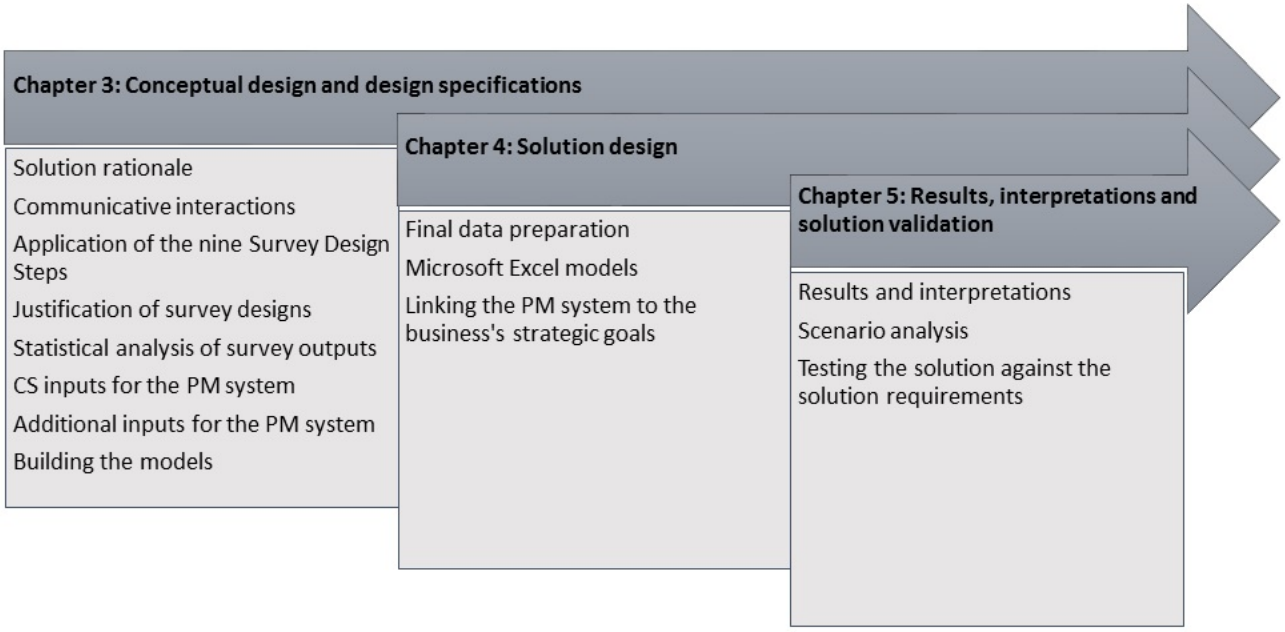


Figure 3.1: **Solution design approach**

A solution rationale is identified to act as the backbone of the solution design and the concepts in this chapter are considered and explored according to this backbone. The business process relating

to the communicative interactions of the Customer Support Centre (CSC) is identified to better understand the role players that will be affected by the designed solution. An application of the nine design steps of the surveys follows with a justification of why the particular survey questions are asked in the manner that they are.

A detailed explanation of the statistical equations to be used can be found following the survey designs. The application of the equations will be incorporated into the solution to provide for accuracy and data integrity. Visual representations of the processed Customer Satisfaction (CS) inputs used in the Performance Measurement (PM) system are explained to prepare for the developed solution. Additional inputs to the PM are also mentioned in this chapter as they will be included in the designed solution to sketch a holistic picture of the CSC's performance.

At the end of this chapter, a decision is made as to how the models, that will process the inputs, will be developed and which software application will be used to develop the models.

3.1 Solution rationale

Figure 3.2 illustrates the solution rationale, in the form of the Suppliers, Inputs, Process, Outputs and Customers (SIPOC) model, that will be followed in order to address the solution requirements and produce the deliverables.

3.2 Communicative interactions

In order to measure the CS of the EXTERNAL AND INTERNAL CUSTOMERS, the communicative interactions between the customers and the CSC need to be understood. Figure 3.3 is a visual representation of the process that the CSC follows when dealing with incoming telephone calls and emails.

Some notable aspects of the process, with regard to customer service, are the actions of monitoring the voice mail box to follow up on calls that came in outside of business hours, "warm transfers" (when an agent who is currently speaking with a caller, announces the call to the requested recipient before transferring the call) of the incoming telephone calls, the chance to leave a message when an INTERNAL CUSTOMER is not available and the monitoring of a mailbox dedicated to customer support.

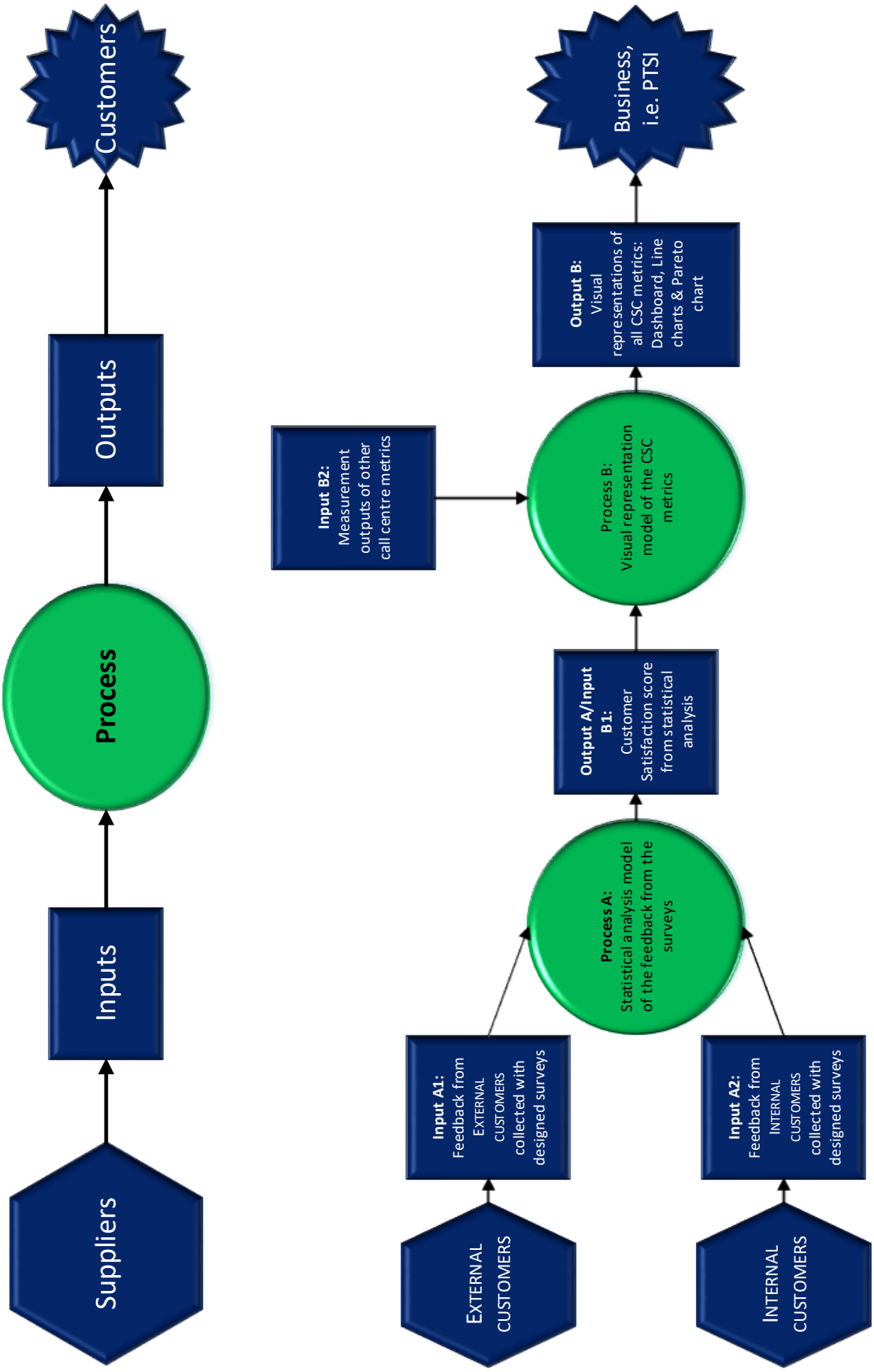


Figure 3.2: **SIPOC model**

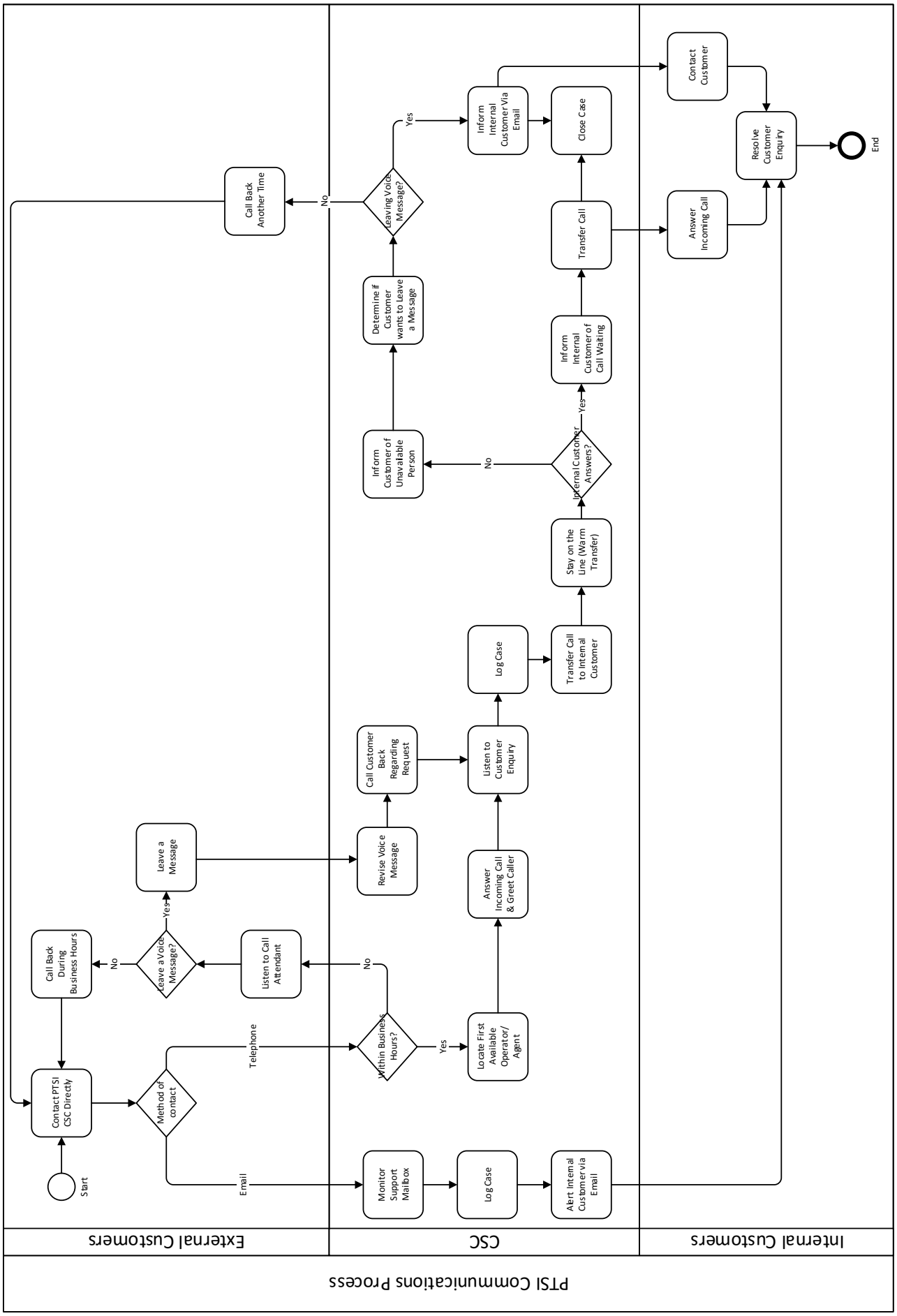


Figure 3.3: **As-is Communications Process**

3.3 Application of the nine Survey Design Steps

By using the process in Figure 3.3 as a reference, the survey designs were done by following the nine survey design steps that Stroud (2010b) defined.

3.3.1 Step 1: Establish the goal

- *External surveys*
  The goal of this survey is to determine the EXTERNAL CUSTOMERS' satisfaction with their interactions with the CSC.

- *Internal surveys*
  The goal of this survey is to determine the INTERNAL CUSTOMERS' satisfaction with their interactions with the CSC.

3.3.2 Step 2: Determine the sample

- *External surveys*
  For the purpose of this project the sample will consist of a representative group of the EXTERNAL CUSTOMERS that contacted Powertech System Integrators (Pty) Ltd (PTSI) through the CSC via telephone and email.

- *Internal surveys*
  For the purpose of this project the sample will consist of a representative group of INTERNAL CUSTOMERS spanning across all the Lines of Business (LoB's) and the other business functions within PTSI. This is possible because of easy access to the INTERNAL CUSTOMERS.

3.3.3 Step 3: Choosing the approach

Simple random sampling will be used for both surveys to keep uniformity.

3.3.4 Step 4: Choosing the format

- *Sample size*
  The optimal sample size formula will be used to determine how many surveys should initially be distributed internally and externally.

$$n = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \frac{z^2 \times p(1-p)}{e^2 \times N}} \tag{3.1}$$

  Where:
  n = the sample size;
  N = the estimated population size;
  p = the probability of success ($p = 0.5$);
  e = the Margin of Error ($e = 0.10$); and
  z = the z-score for setting the confidence level ($z = 1.645$, because of a 90% confidence level).

- *Distribution period*
  The targeted period of survey distribution spans 30 days.

- *External surveys*
  The distribution channels for the surveys will be telephonic and via email.

- *Internal surveys*
  The distribution channels for the surveys will be telephonic, through face-to-face interviews and printed surveys.

- *Cost*
  The cost of distributing the surveys and analysing their results will include the telephone costs and the salary for a part-time intern.

3.3.5 Steps 5 and 6: Creating the survey and writing quality questions

- *External surveys*
  The three questions of the American Customer Satisfaction Index (ACSI) and the single question of the Customer Effort Score (CES) were chosen for this survey because the answers to these questions address the goals that were established in Step 1. All the questions will be assessed on a scale from 1-5 in order to make the analysis of the results less complicated and easier to use.

- *Internal surveys*
  The three questions of the ACSI were chosen for this survey because the answers to these questions address the surveys' goal from Step 1. All three questions will also be assessed on a scale from 1-5. A fourth question will be included enquiring about the reasons for the answers to the other three questions. These reasons will be grouped according to types, analysed and interpreted.

3.3.6 Step 7: Pre-testing the survey

The use of tested and widely accepted customer feedback tools remove the need for pre-testing and no ethical review is needed as the survey will only evaluate the services of PTSI and the CSC.

3.3.7 Steps 8 and 9: Administering the survey and analysing the results

The administering of the email surveys will be done by using the SurveyMonkey platform as it is a familiar and efficient platform. Details of analysis follow in Section 4.3.

3.4 Justification of survey designs

The following table is an explanation of the choice of questions for the external and internal surveys, respectively.

Table 3.1: **The justification of survey question choices**

	Question to be asked	Reason for external survey	Reason for internal survey	Scale to be used for the question	Type of question response
1.	What is your overall satisfaction with our service?	To determine the EXTERNAL CUSTOMERS' overall opinion of the CSC business function of PTSI.	To determine the INTERNAL CUSTOMERS' overall opinion of the CSC business function of PTSI.	1 to 5, where 1 is "Very dissatisfied" and 5 is "Very satisfied"	Multiple choice.
2.	To what extent has our service met your expectations?	To establish the EXTERNAL CUSTOMERS' expectations of the CSC business function.	To establish the INTERNAL CUSTOMERS' expectations of the CSC business function.	1 to 5, where 1 is "It did not meet my expectations at all' and 5 is "It met my expectations exactly".	Multiple choice.
3.	How much effort did you personally have to expend to have your request resolved?	To determine the EXTERNAL CUSTOMERS' perception of the CSC business function's efficiency.	N/A	1 to 5, where 1 is "A lot of personal effort" and 5 is "Very little personal effort".	Multiple choice.
4.	How well did our service compare to what you would consider the ideal offering?	Opportunity to establish the EXTERNAL CUSTOMERS' ideal offering of a similar function to the CSC.	Opportunity to establish the INTERNAL CUSTOMERS' ideal offering of the CSC as a business function.	1 to 5, where 1 is "It compares very poorly" and 5 is "It compares very well".	Multiple choice.
5.	Would you please give reasons for your answers to the questions above?	N/A	To identify reasons for dissatisfaction of INTERNAL CUSTOMERS.	N/A	Text.

3.5 Statistical analysis of survey outputs

For the results of a survey to be significant to the business, the Response Rate (RR) must be greater than 80% (Brogle, 2014). The RR will be calculated by using the following formula:

$$RR(\%) = \frac{n}{N} \times 100 \tag{3.2}$$

The sample size of the analysis will only be the number of responses received and is denoted as n and N represents all the surveys distributed.

After the results of the returned surveys are input into the calculation sheet the following calculations will be available:

1. The average CS score per survey

$$AverageScore/Survey = \bar{y} = \frac{\sum y_i}{Total\#ofQuestions}, i = 1, 2, 3, 4 \tag{3.3}$$

2. The average score per question (four questions for the external surveys and three for the internal surveys)

$$AverageScore/Question = \bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{3.4}$$

3. The mean CS score

$$MeanCSScore = \bar{\bar{y}} = \frac{\bar{y}}{n} \tag{3.5}$$

4. The median CS score

$$Median = y_m = \bar{y}_{\frac{n+1}{2}} \tag{3.6}$$

when n is an odd number

$$Median = y_m = \frac{\bar{y}_{\frac{n}{2}} + \bar{y}_{\frac{n+2}{2}}}{2} \tag{3.7}$$

when n is an even number

5. The variance and standard deviation (σ)

$$Variance = \frac{\sum_{i=1}^{n}(\bar{y}_i - \bar{\bar{y}})}{n} \tag{3.8}$$

$$\sigma = \sqrt{Variance} \tag{3.9}$$

6. To test the accuracy of the data, the margin of error (e), based on the mean CS score and the predetermined confidence level (Initial $z = 1.645$), is calculated.

$$e = z \times \frac{\sigma}{\sqrt{n}} = \frac{1.645\sigma}{\sqrt{n}} \tag{3.10}$$

7. The optimal sample size will then be determined once again after testing the accuracy of the data and the re-evaluation of the adequacy of the confidence level.

From the calculations from the surveys' outputs, it can be noted that a cyclic pattern appears. Figure 3.4 is the visual representation of the cyclic pattern to the statistical analysis of the survey outputs as explained.

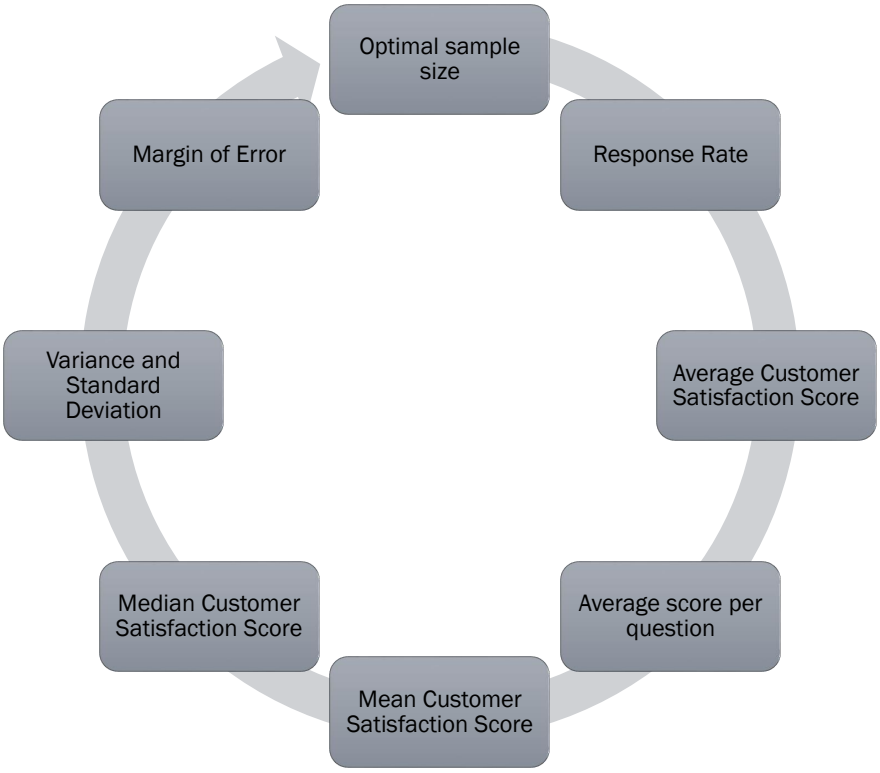


Figure 3.4: **Cyclic pattern of the statistical analysis of the survey outputs**

The statistical attributes were chosen for the mathematical models for the EXTERNAL AND INTERNAL FEEDBACK TOOLS, because of their statistical significance. The attributes will all be automatically calculated by the two survey models, but one attribute will need manual intervention. This will be the grouping of the reasons according to type given as answers to the fourth question of the internal survey. The groupings will be used to generate a Pareto chart to determine the groups that cause the greatest dissatisfaction among the INTERNAL CUSTOMERS.

3.6 CS inputs for the PM system

The attributes mentioned in Section 3.5 are all statistically significant, but not necessarily relevant when it comes to the measurement of the CSC's performance. They are also not as easy to interpret in a statistical format.

The proposed solution to this obstacle is the use of line charts and the Upper and Lower Specification Limits concept of statistical quality control principles for the visual representation of the survey scores. The charts are a graphical display of a quality characteristic of a sample measured over time, to show that a process is in control (Montgomery, 2013). In this project, the limits can be used to identify classes of customers and develop strategies to engage with them accordingly.

These line charts will be used to plot n on the x-axis, the $\bar{y}$ values on the y-axis and the Target Value (TV) will also be a line on the graph. The $\bar{\bar{y}}$ will be presented as the centre line on the line chart for segmentation, as well as on a gauge chart to show the overall CS of the INTERNAL AND EXTERNAL CUSTOMERS. Specification limits will be decided upon and included on the line charts. The data will be presented in a manner similar to Figure 3.5.

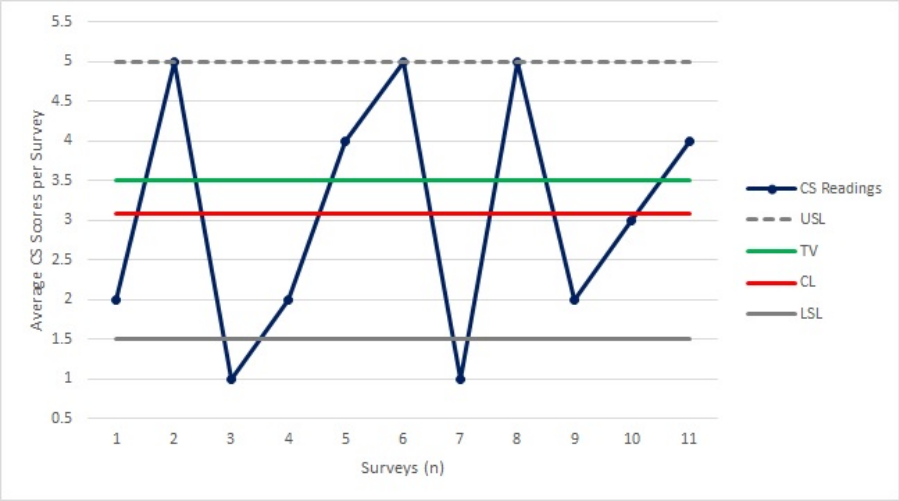


Figure 3.5: **Conceptual graphical representation of the survey results by means of line charts**

In a case like this, a the-Higher-the-Better one-sided scenario is applicable, because the optimal would be if the CS scores were as high as possible. This means that the only applicable specification limit would be the Lower Specification Limit (LSL) to ensure that the scores do not cross that limit.

The reason why the one-sided scenario was not chosen alone, is to enable the user to potentially identify different groups of customers and to then devise engagement strategies to improve the overall CS score of the business function.

The Pareto principle states that quality losses within a process are not distributed evenly and that a small proportion of possible causes are responsible for the bulk of the quality problems. Plainly stated, only a few "bad apples" account for the majority of the experienced quality losses. A Pareto chart (Figure 3.6) is used to visually illustrate the distribution of the quality losses across relevant categories by using a histogram (StatSoft, 2000). The order of the categories is descending in the order of importance and here the categories will be arranged in descending order of frequency of reason category.

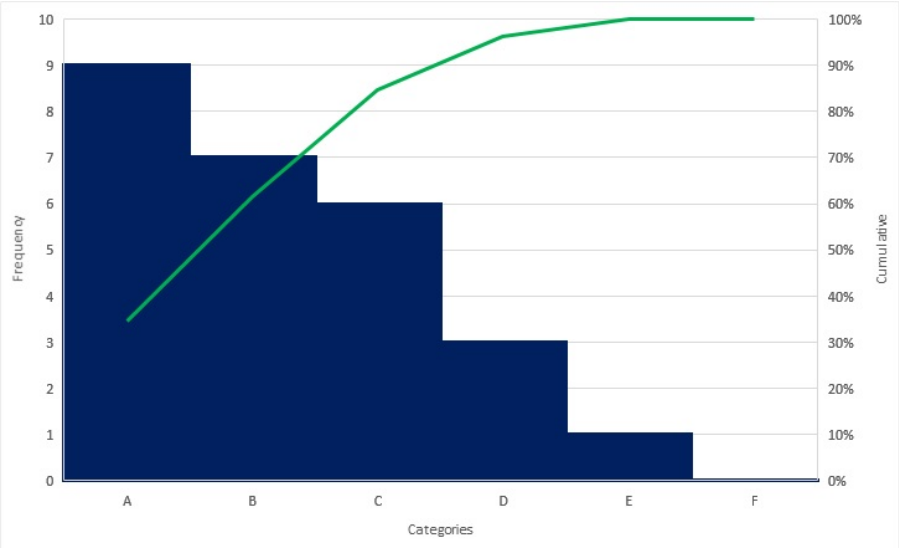


Figure 3.6: **Conceptual graphical representation of the reason groupings by means of a Pareto chart**

3.7 Additional inputs for the PM system

The call centre metrics mentioned in Chapter 2 can be converted to visual representations and added on the dashboard in order to get an overall view of the performance of the CSC. All the charts will be displayed in a dashboard format with an interpretation linked to each graph.

Due to the additional first-tier support that the CSC provides to PTSI's Engineering Information Systems (EIS) and Energy Management (EM) clients there exists a need for the measuring of the performance of those services. Additional to the first-tier support, the capturing of incoming calls, that are routed through the CSC, should be measured, too. After consultation, it was determined that the following aspects should be measured in order to determine the efficacy of the implemented solutions along with the efficiency of the CSC's support:

- Number of abandoned incoming calls from the Private Branch Exchange (PBX) system
- Number of successfully transferred incoming calls
- Number of messages taken for unsuccessfully transferred incoming calls

- Number of recorded support calls for each of the supported LoB's
- Number of resolved support calls for each of the supported LoB's
- Time-to-Resolution (TTR) of the resolved support calls

The sources of these aspects include the current PBX system and the implemented Software-as-a-Service Customer Relationship Management (CRM) solution. The outputs of the sources need some extra intervention to facilitate incorporation into the developed PM system. The intervention can also be seen as a model of sorts because it should be able to process the outputs of the systems as inputs and produce answers that are understandable and usable.

3.8 Building of the models

The three models need to be designed and built in a software application that will be easy for the end user to use and possess the necessary calculation abilities to do the required calculations. Four alternatives were considered for this purpose and Table 3.2 summarises the advantages and disadvantages of each considered alternative.

The conclusion that was drawn from considering the alternatives, was that the three models would be built in Microsoft Excel, because of the application's versatility and ease of use. Another reason for building the models in MS Excel is that the models' end users are familiar and comfortable with the format. The protection functions of MS Excel would be used to prevent tampering and unauthorised changes to the models. Other formats might be more advanced and maybe even safer, thus further investigation of possible alternatives could be considered as an expansion of this project.

Table 3.2: **Summary of the advantages and disadvantages of available software application alternatives**

Considered Alternative	Advantages	Disadvantages
Microsoft Excel	• Familiarity for end user • Current tool used for reporting • Protection settings available to secured worksheets • Data processing easier with native Pivot Tables and Pivot Charts • Links to external data sources available for automated importing of data • No extra costs need to be incurred to acquire the program	• Little to no automatic version control • Potential for inaccurate outputs due to broken links or formulae • Links to external data sources for automatic importing only available in latest MS Office (2016) • Can't be effectively hosted and must be stored on internal shared Drives • User interface not attractive
Microsoft Access Database	• Relational databases enable relating important attributes of tables with each other in the background • Use of forms as the user interfaces possible • Forms make for attractive user interfaces • Good protection settings • Good version control • Can be hosted for multiple party access	• Unfamiliar tool to most end users • Need for extensive training to create familiarity • Have to export data to MS Excel for data processing with Pivot tables
Custom Form-Based Microsoft SharePoint Application	• Use of forms as the user interfaces possible • Forms make for attractive user interfaces • Potential solution for the future	• Needs design and development from scratch • Undefined in-house development abilities • Timely and costly if developed externally • External party implementation if developed externally
Third Party Software Application	• Potentially exciting application ("New Toy" Effect) • Requires an in-depth analysis to determine its suitability for PTSI	• Costly • External party implementation

Chapter 4

Solution design

A culmination of the concepts explained in Chapter 3 results in the following solution. Starting off with the preparation of the data needed as inputs to the Customer Satisfaction (CS) models. This preparation requires some equations described in Chapter 3 and the rest of the equations are incorporated into the Excel models. The models are finally presented and explained.

4.1 Final data preparation

Seeing as random sampling was chosen as the sampling approach, data preparation is required to ensure the feedback from the customers is representative of the total population. The sample size is determined using the equation explained earlier and then broken up as to ensure further representativity.

4.1.1 Initial sample sizes

The formula explained in Section 3.3.4, with certain predetermined attributes, was used to determine the EXTERNAL AND INTERNAL CUSTOMER sample sizes, respectively. A predetermined Margin of Error, confidence level and a probability of success was decided upon. The resulting sample sizes are shown in Table 4.1:

Table 4.1: **Sample size calculations**

	Margin of Error (e)	Confidence Level (%)	z - value	Probability of Success (p)	Estimated Population Size (N)	Calculated Sample Size (n)
External Customers	0.10	90	1.645	0.50	385	58
Internal Customers					204	51

Figures 4.1 and 4.2 show how the predetermined aspects and the sample sizes are displayed in the Excel models to enable processing in the models.

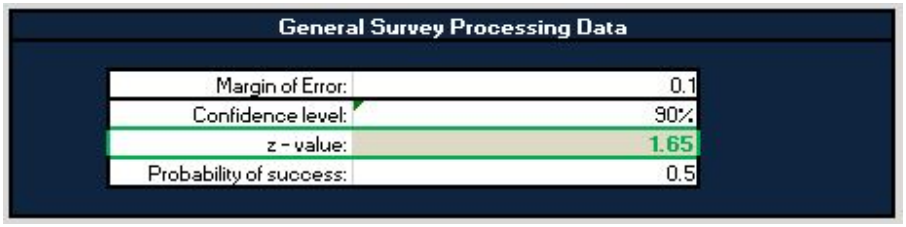


Figure 4.1: **Attributes decided upon beforehand**

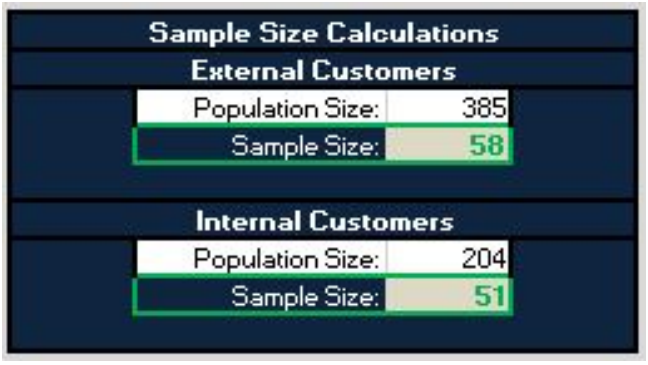


Figure 4.2: **Sample sizes calculated based on the attributes decided upon**

4.1.2 External customers' comparability and representativity

The EXTERNAL CUSTOMERS of Powertech System Integrators (Pty) Ltd (PTSI) are considered comparable with each other based on the fact that they make use of the Customer Support Centre (CSC) to contact the business and they all are the source of the business's income. From a representativity aspect, they can be segmented according to the market sectors they trade in and how much revenue is generated from PTSI doing business with them. If an increase in delivered solutions in a specific sector occurs, then an increased need for contact and support will inevitably follow. A greater need for contact and support leads to increased volumes of interactions with the CSC of PTSI. When the CSC interacts with customers from a certain sector regularly, it becomes paramount that the customers are satisfied with those interactions.

Customer, revenue and market sector data were sourced from the PTSI Enterprise Resource Planning system, from the 2010-2011 financial year to the 2105-2016 financial year, to determine a representative sample of the external surveys. Table 4.2 is the breakdown of the number of surveys to be sent out based on the initial sample size calculated. Figure 4.3 shows a visual representation of the current segmentation of PTSI customers based on the revenue generated from solutions provided to them across all the Lines of Business (LoB's) and the market sector they trade in.

Table 4.2: **Breakdown of the number of surveys to be distributed to external customers**

Market Sector	Percentage of revenue for FY 2010-2016	Number of surveys to be distributed
Electrical Utilities - Eskom Distribution	36%	21
Mining, Metals, Minerals & Manufacturing	15%	9
Electrical Utilities - SA Metros & Munics	10%	6
E_DSM	8%	5
Electrical Equipment OEMs	6%	4
Electrical Utilities - Eskom Transmission	5%	3
Telecommunications Utilities	4%	2
Electrical Utilities - SSA	3%	2
Paper, Pulp & Petrochemical	2%	1
Other	2%	1
Substation Construction Contractors	2%	1
IT Consulting & Services	1%	1
Water	1%	1
Food products & Services	1%	0
Electrical Utilities - Eskom Generation	1%	1
Financial	1%	0
Motor Vehicle Manufacturers & Service Providers	1%	0
Transport	1%	0
Electrical Consulting & Services	1%	0
Additional Sectors	1%	1
TOTAL	100%	58

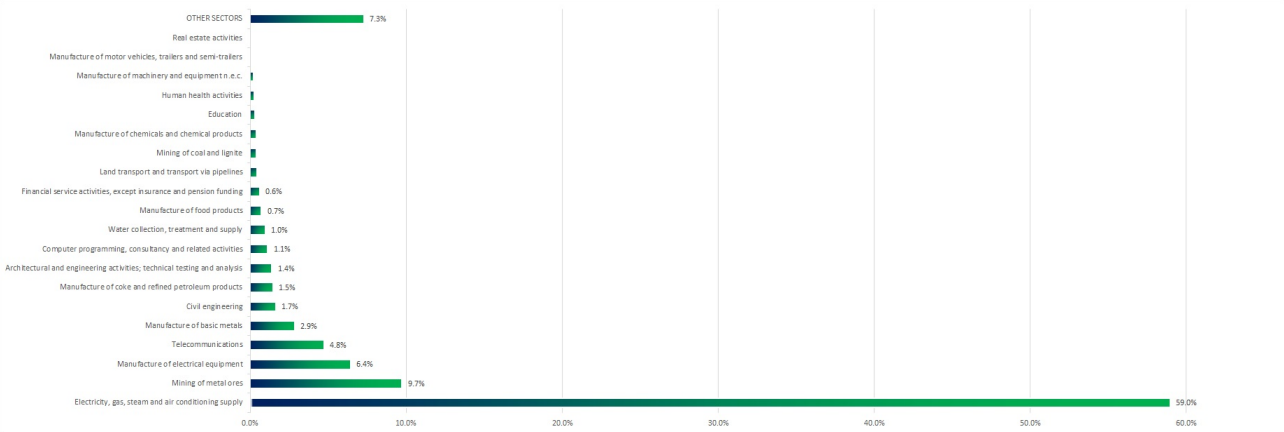


Figure 4.3: **External customers' segmentation**

4.1.3 Internal customers' comparability and representativity

The comparability of the INTERNAL CUSTOMERS of the CSC is based firstly on the fact that all of them are employees of PTSI and secondly on an internal business rule that states that as many as possible external calls should be channelled through the CSC to the employees (refer to Figure 3.3 for

the As-Is Communications Process).

An organisational chart of the various departments and LoB's in PTSI can be used to determine the representativity of the INTERNAL CUSTOMERS. Table 4.3 is the breakdown of the internal surveys to be distributed based on the initial sample size calculated and Figure 4.4 shows a visual representation of the current segmentation of the INTERNAL CUSTOMERS according to the PTSI organisational chart.

Table 4.3: **Breakdown of the number of surveys to be distributed to internal customers**

PTSI Department/LoB	Number of People	Percentage of Total	Number of Surveys to be Distributed
Corporate	13	6%	3
Finance	21	10%	5
Operations & Facilities	15	7%	4
Business Systems	3	1%	1
Human Resources	3	1%	1
SHERQ	7	3%	2
Business Development - Africa	2	1%	1
Marketing & Business Development	17	8%	4
IPP	24	12%	6
EIS	26	13%	7
PIM	40	20%	9
EM	33	16%	8
TOTAL	**204**	**100%**	**51**

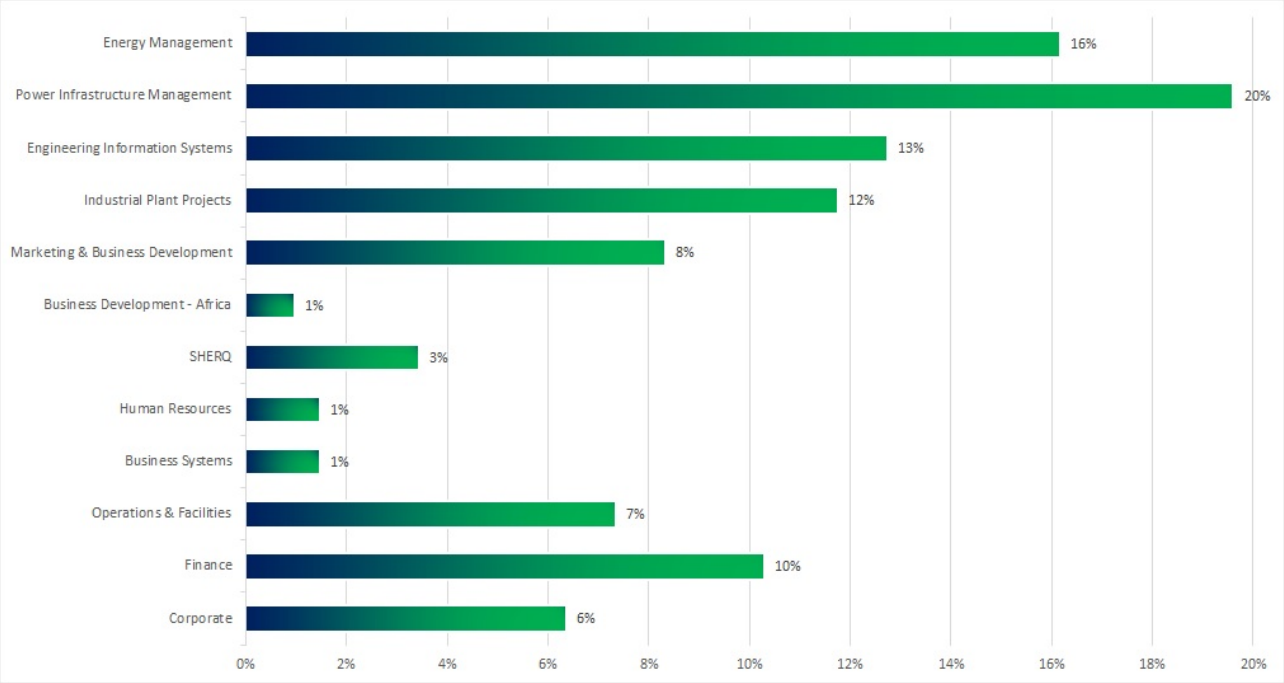


Figure 4.4: **Internal customers' segmentation**

A detailed design of the internal survey is included in Appendix A along with the script followed

for the telephonic surveys.

4.1.4 Preparation of the additional inputs

PTSI uses a Private Branch Exchange (PBX) as a telephone switching system within the business. The number of incoming calls from external sources is recorded along with the duration of the waiting time before the call is answered and the duration of the calls themselves. The system also records the number of abandoned calls, which are calls that could not be answered because they were ended in the first 10 seconds of the total call duration. These results can be used to determine the average call duration of the CSC due to the fact that all external incoming calls are routed through the CSC.

The incoming calls that are transferred successfully and the unsuccessfully transferred calls are all recorded using the implemented Customer Relationship Management (CRM) system that have been configured to the specifications of PTSI. The records of the first-tier support that the CSC provides to the LoB's are also captured in the CRM system and can thus be reported on. A functionality to create reports within the system exists and the reports can be exported in an Excel format for easy simplification of the data.

The simplification of the exported data from the CRM system is done by using the Pivot Table and Pivot Chart functionality of Excel. The Pivot Table presents the data in a comprehensible format and the Pivot Chart presents the data from the Pivot Table visually. Using Pivot Tables and Charts are beneficial when working with dynamic data because they change as the data changes.

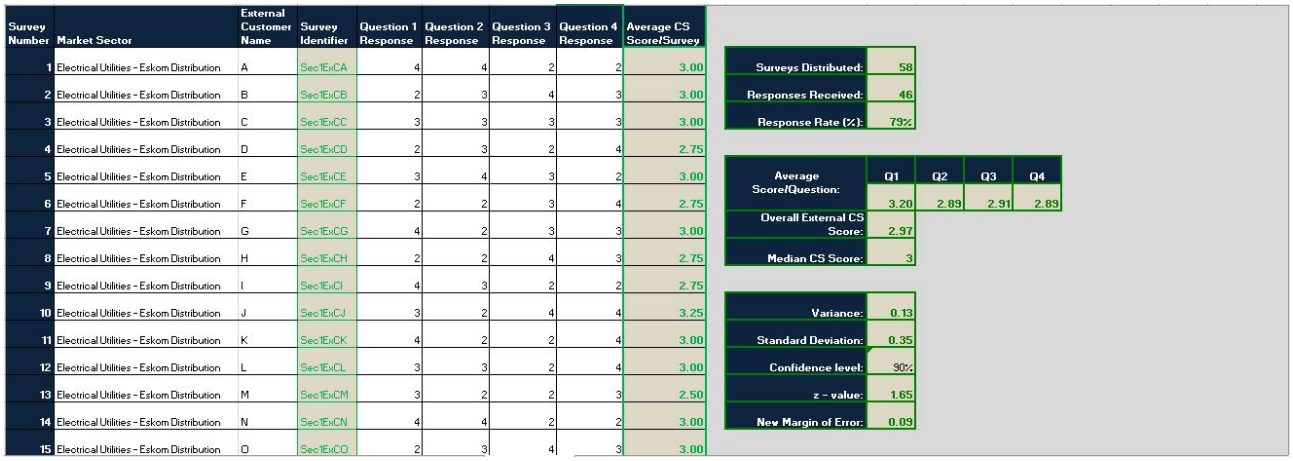
4.2 Microsoft Excel models

Two models were developed to process the outputs of the customer feedback tools and a third model was developed to process all the other additional inputs relevant to the Performance Measurement (PM) system of the CSC.

4.2.1 Model 1: External Customer Satisfaction

The outputs of the customer feedback tool used to measure the CS the EXTERNAL CUSTOMERS are presented as shown in Figure 4.5. The recorded responses are populated in the white blocks as they are the data source for the calculations and processing taking place on the sheet. The processed data is then displayed in green to differentiate between captured and processed data.

The statistical attributes referred to in Section 3.5 are calculated and displayed for control purposes. The most relevant information is displayed on the dashboard for easy reporting.



Survey Number	Market Sector	External Customer Name	Survey Identifier	Question 1 Response	Question 2 Response	Question 3 Response	Question 4 Response	Average CS Score/Survey
1	Electrical Utilities - Eskom Distribution	A	Sec1ExCA	4	4	2	2	3.00
2	Electrical Utilities - Eskom Distribution	B	Sec1ExCB	2	3	4	3	3.00
3	Electrical Utilities - Eskom Distribution	C	Sec1ExCC	3	3	3	3	3.00
4	Electrical Utilities - Eskom Distribution	D	Sec1ExCD	2	3	2	4	2.75
5	Electrical Utilities - Eskom Distribution	E	Sec1ExCE	3	4	3	2	3.00
6	Electrical Utilities - Eskom Distribution	F	Sec1ExCF	2	2	3	4	2.75
7	Electrical Utilities - Eskom Distribution	G	Sec1ExCG	4	2	3	3	3.00
8	Electrical Utilities - Eskom Distribution	H	Sec1ExCH	2	2	4	3	2.75
9	Electrical Utilities - Eskom Distribution	I	Sec1ExCI	4	3	2	2	2.75
10	Electrical Utilities - Eskom Distribution	J	Sec1ExCJ	3	2	4	4	3.25
11	Electrical Utilities - Eskom Distribution	K	Sec1ExCK	4	2	2	4	3.00
12	Electrical Utilities - Eskom Distribution	L	Sec1ExCL	3	3	2	4	3.00
13	Electrical Utilities - Eskom Distribution	M	Sec1ExCM	3	2	2	3	2.50
14	Electrical Utilities - Eskom Distribution	N	Sec1ExCN	4	4	2	2	3.00
15	Electrical Utilities - Eskom Distribution	O	Sec1ExCO	2	3	4	3	3.00

Surveys Distributed:	58
Responses Received:	46
Response Rate (%):	79%

Average Score/Question:	Q1	Q2	Q3	Q4
	3.20	2.89	2.91	2.89

Overall External CS Score:	2.97
Median CS Score:	3
Variance:	0.13
Standard Deviation:	0.35
Confidence level:	90%
z - value:	1.65
New Margin of Error:	0.09

Figure 4.5: **Outputs of external surveys used as inputs for the PM system**

4.2.2 Model 2: Internal Customer Satisfaction

The INTERNAL CUSTOMERS' feedback tool outputs appear to be similar to that of the EXTERNAL CUSTOMERS. They differ due to the groupings of the responses provided to the fourth question of the internal surveys. Figure 4.6 shows that the recorded responses to the first three questions are input in the same manner as those of the external surveys, but that a drop-down list was added for the groupings of the responses to the fourth question.

Survey Number	Department/LoB	Internal Customer Name	Survey Identifier	Question 1 Response	Question 2 Response	Question 3 Response	Question 4 Response	Coding of Response	Average CS Score/Survey
1	Corporate	A	Dep1InCA	3	3	3	Incorrect resolution	A1	3.00
2	Corporate	B	Dep1InCB	2	3	3	Poor listening	A4	2.67
3	Corporate	C	Dep1InCC	1	1	1	Weak oral skills	A5	1.00
4	Finance	A	Dep2InCA	3	3	2	Poor conversation control	A8	2.67
5	Finance	B	Dep2InCB	1	3	2	Unclear/undefined policies	B2	2.00
6	Finance	C	Dep2InCC	1	2	3	Distracting	C1	2.00
7	Finance	D	Dep2InCD	3	2	3	Ineffective	C3	2.67
8	Finance	E	Dep2InCE	1	2	1	External callers wait long time to be transferred	D1	1.33
9	Operations & Facilities	A	Dep3InCA	3	2	2	Internal receivers refusing to have calls transferred to them	D2	2.33
10	Operations & Facilities	B	Dep3InCB	3	3	1	Constrictive policies	B1	2.33
11	Operations & Facilities	C	Dep3InCC	1	1	3	Intrusive	C2	1.67
12	Operations & Facilities	D	Dep3InCD	2	2	1	Ineffective	C3	1.67
13	Business Systems	A	Dep4InCA	2	1	2	External callers wait long time to be transferred	D1	1.67
14	Human Resources	A	Dep5InCA	1	3	3	Weak written skills	A6	2.33
15	SHERQ	A	Dep6InCA	1	2	3	Rudeness/insolence	A7	2.00

Surveys Distributed:	51
Responses Received:	51
Response Rate (%):	100%

Average Score/Question:	Q1	Q2	Q3
	2.00	2.06	2.02

Overall Internal CS Score:	2.03
Median CS Score:	2
Variance:	0.26
Standard Deviation:	0.51
Confidence level:	90%
z - value:	1.65
New Margin of Error:	0.12

Figure 4.6: **Outputs of internal surveys used as inputs for the PM system**

The drop-down list consists of reason categories that are codified, as displayed in Figure 4.7. The main reason for codification, in this case, is to simplify the data processing into a visual display. Categorisation of the reasons can be used as an indication of where exactly the most satisfaction or dissatisfaction with the business function lies.

Codification of Grouping Data for Internal Surveys			
Identified dissatisfactions			Code
A - Support Process Related	Knowledge issues	Incorrect resolution	A1
		Incomplete resolution	A2
		Issue misidentification	A3
	Communication issues	Poor listening	A4
		Weak oral skills	A5
		Weak written skills	A6
	Behavioural issues	Rudeness/insolence	A7
		Poor conversation control	A8
		Inpatience	A9
		Indifference	A10
B - Support Policies Related		Constrictive policies	B1
		Unclear/undefined policies	B2
		Unnecessary policies	B3
C - Service Related Issues		Distracting	C1
		Intrusive	C2
		Ineffective	C3
		Incomplete	C4
D - Misc		External callers wait long time to be transferred	D1
		Internal receivers refusing to have calls transferred to them	D2

Figure 4.7: **Codification of the reasons given by the internal customers**

The visual displays of the processed and codified data also appears on the dashboard of the PM system for easy reporting and a visual comparison to the external CS data.

Specification limits

The specification limits for both INTERNAL AND EXTERNAL CUSTOMERS were set at 5 and 1 and the Target Values (TV's) were chosen as 3 for INTERNAL CUSTOMERS and 3.5 for EXTERNAL CUSTOMERS.

Figure 4.8 shows all the Limits together as they apply to EXTERNAL AND INTERNAL CUSTOMERS.

Specification Limits	
External Customers	
Sigma:	0.35
Upper Spec Limit (USL):	5.00
Target Value (TV):	3.50
Centre Line (CL):	2.97
Lower Spec Limit (LSL):	1.00
Internal Customers	
Sigma:	0.51
Upper Spec Limit (USL):	5.00
Target Value (TV):	3.00
Centre Line (CL):	2.03
Lower Spec Limit (LSL):	1.00

Figure 4.8: **Warning and control limits based on the external and internal customer feedback**

4.2.3 Model 3: Additional Performance Measurement inputs

PBX system inputs

The PBX system's report has to be manually captured (Figure 4.9) in this PM system because the PBX does not have the integration capabilities to make it a seamless solution. The report is of importance when it comes to measuring the total number of incoming and outgoing calls along with the call loss rate and the call service level of the CSC as a business function, in order for it to be included in the PM system.

A gauge chart, available as an Add-In for Excel, is an effective way to visually display the most important metric from the PBX system. A gauge chart was added to the dashboard to display the service level of the CSC's call taking activities.

PABX Inputs	Year	Month	Grand Total	Total	Answered	Abandoned	Call loss rate	Service level	Average Ring Time	Average Call Duration	Total	Average Call Duration
	2016	June	3919	3318	3085	233	7%	93%	0:00:07	0:02:03	601	0:02:46
	2016	July	3914	3419	3154	265	8%	92%	0:00:14	0:01:33	495	0:03:14
	2016	August	0	0								
	2016	September	0	0								
	2016	October	0	0								
	2016	November	0	0								
	2016	December	0	0								
				Incoming Calls							Outgoing Calls	

Figure 4.9: **Outputs from the PBX system**

CRM system inputs

The CRM system outputs, in the form of exported reports, also requires some manual intervention before being included in the PM system of the CSC. The Pivot Tables that were constructed from the exported reports are shown in Figure 4.10. The inter-connectivity between the Pivot Tables and the Pivot Charts makes it possible to easily move back and forth between the graphic and the tabular views of the exported data. The Pivot Charts, that are linked to the Pivot Tables, are included on the dashboard of the PM system because they are easier to read and thus easier to report on.

All Recorded Cases per Record Type	Column Labe		
Row Labels	0	1	Grand Total
Incoming Call	1047	7	1054
Engineering Information Systems (EIS)	6	25	31
EDA Support (EIS)	19	97	116
ecWin Support (EM)	9	42	51
Grand Total	**1081**	**171**	**1252**

(a) All recorded cases per record type

All Resolved Cases per Record Type		
Row Labels	# of Resolved Cases per Record Type	Average TTR (Days)
Incoming Call	1047	0.7
Engineering Information Systems (EIS)	6	10.0
EDA Support (EIS)	19	16.2
ecWin Support (EM)	9	10.2
Grand Total	**1081**	**1.1**

(b) All resolved cases per record type

All Incoming Calls per CSC Agent	Column Labels		
Row Labels	0	1	Grand Total
Agent 1	8	4	12
Agent 2	31	29	60
Agent 3	145	72	217
Agent 4	81	66	147
Agent 5	15	6	21
Agent 6	237	239	476
Agent 7	105	39	144
Grand Total	**622**	**455**	**1077**

(c) All incoming calls per CSC agent

EIS Recorded Cases		
Row Labels	# of Recorded EIS Cases per Minor LoB	Average of Age (Days)
⊞DMS/OMS/NMS	4	21.3
⊞EAM	10	24.7
⊞GIS	6	20.3
⊞Mobility	11	20.6
Grand Total	**31**	**22.0**

(d) EIS recorded cases

EDA Recorded Cases		
Row Labels	# of Recorded Cases per EDA Model	Average of Age (Days)
⊞M67 Hardware	44	25.5
⊞M67 Software	14	26.7
⊞M75 Hardware	12	30.3
⊞M75 Software	46	26.8
Grand Total	**116**	**26.6**

(e) EDA recorded cases

ecWin Recorded Cases		
Row Labels	# of Recorded Cases per ecWin SIte	Average of Age (Days)
ecWinSite1	2	39.0
ecWinSite2	2	38.5
ecWinSite3	2	37.5
ecWinSite4	2	24.0
ecWinSite5	2	37.5
ecWinSite6	2	35.5
ecWinSite7	4	28.3
ecWinSite8	3	26.3
ecWinSite9	4	14.5
ecWinSite10	3	25.7
ecWinSite11	4	14.8
ecWinSite12	3	11.0
ecWinSite13	1	5.0
ecWinSite14	2	14.0
ecWinSite15	2	13.5
ecWinSite16	1	1.0
ecWinSite17	4	16.0
ecWinSite18	2	10.0
ecWinSite19	2	12.5
ecWinSite20	1	18.0
ecWinSite21	3	12.0
Grand Total	**51**	**20.9**

(f) ecWin recorded cases

Figure 4.10: **Pivot Tables created from exported CRM reports**

The concept of "Record Types" is used in the CRM as a way to differentiate between business processes, pick-list values and page layouts. Record Types facilitate ease-of-use for different business functions who use the CRM for conducting business. The details surrounding the design and setup of the Record Types are out of scope for this project.

4.3 Linking the PM system to the business's strategic goals

Hudson et al. (2001) identify criteria that a PM system should adhere to, to be considered as a strategic

PM system (Section 2.3.2). This approach was followed and a homepage for the CSC's PM system was designed. The homepage enables the user to link the CSC's goals and objectives to the business strategy and see where the CSC fits into the bigger picture of the business. It also links the goals and objectives to metrics. The metrics are linked via hyperlinks to their visual representations on the dashboard to make them easy to find and report on.

Appendix B contains the designed homepage with the business function goals and objectives relating to customer satisfaction and first-tier support already populated. This homepage can be expanded should additional goals and objectives be added.

The activities portion of the homepage enables the period to period tracking of the necessary activities and their due dates. This enables the business function to accomplish the identified goals and objectives to further facilitate the business's strategy. The activities should be updated, by the user, manually during every reporting period to keep up to date with the progress of the activities. The symbols in the left-hand corner can be used to state the progress of the activities.

Chapter 5

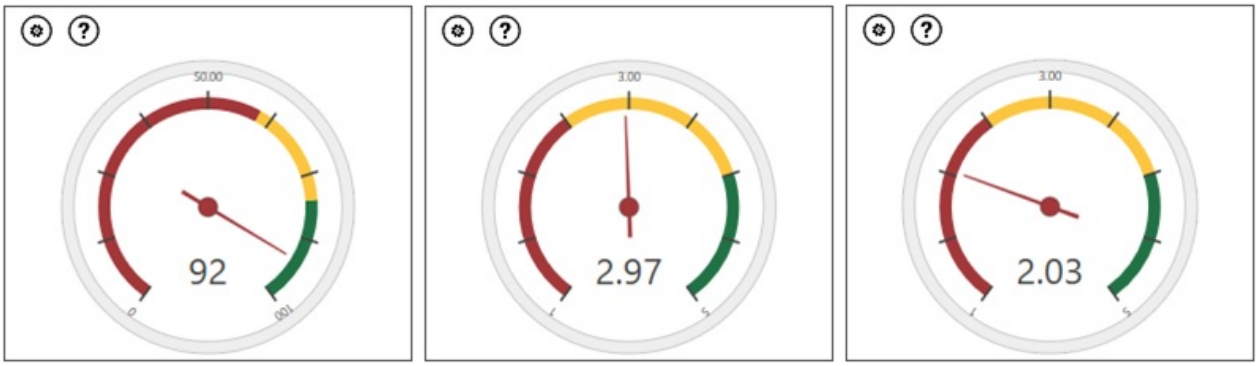
Results, interpretations and solution validation

In this chapter, the results are presented along with their interpretations. The solution is then validated and conclusions are drawn. Finally, future work is discussed.

5.1 Results and interpretations

The results obtained from the customer feedback tools along with the additional Performance Measurement (PM) inputs are discussed in this section. The outputs of the Customer Satisfaction (CS) models are discussed in detail and interpreted. The additional inputs are shortly explained in the context of what they mean to the Customer Support Centre (CSC) from a performance perspective. A dashboard is used to display the results, is also discussed.

The first three displays on the dashboard are called gauge charts, which displays a single result on a spectrum broken up into desirable, intermediate and undesirable ranges. The first gauge chart displays the Private Branch Exchange (PBX) service level and the following gauge charts show the CS scores of the EXTERNAL AND INTERNAL CUSTOMERS, respectively.



(a) Overall PBX service level of the CSC

(b) Overall EXTERNAL CUSTOMERS' satisfaction with the CSC

(c) Overall INTERNAL CUSTOMERS' satisfaction with the CSC

Figure 5.1: **Gauge charts displayed on the PM system dashboard**

Figure 5.1a shows that the CSC's service level regarding the PBX system is remarkably high at

92%, and a conclusion can be drawn that the business function focuses on answering every external call coming into Powertech System Integrators (Pty) Ltd (PTSI). The abandoned calls causing the missing 8% of the service level was identified as the improvement opportunity regarding the service level.

From Figure 5.1b it can be seen that the EXTERNAL CUSTOMERS' overall satisfaction with the CSC only measures at a 2.97 out of 5. This is a troubling, but a redeemable result. Serious attention and effort will be needed to improve on the overall external CS.

A revealing and troubling result was observed when analysing the INTERNAL CUSTOMERS' overall satisfaction. From Figure 5.1c it can be seen that the INTERNAL CUSTOMERS of the business function are very dissatisfied with its service. The reason groupings (Figure 4.7) also mainly consist out of dissatisfaction from the PTSI employees' perspectives.

The following two charts (Figures 5.2 and 5.3) are the line charts described in Section 3.6 and display the EXTERNAL AND INTERNAL CUSTOMERS' segmentation according to their responses on the surveys.

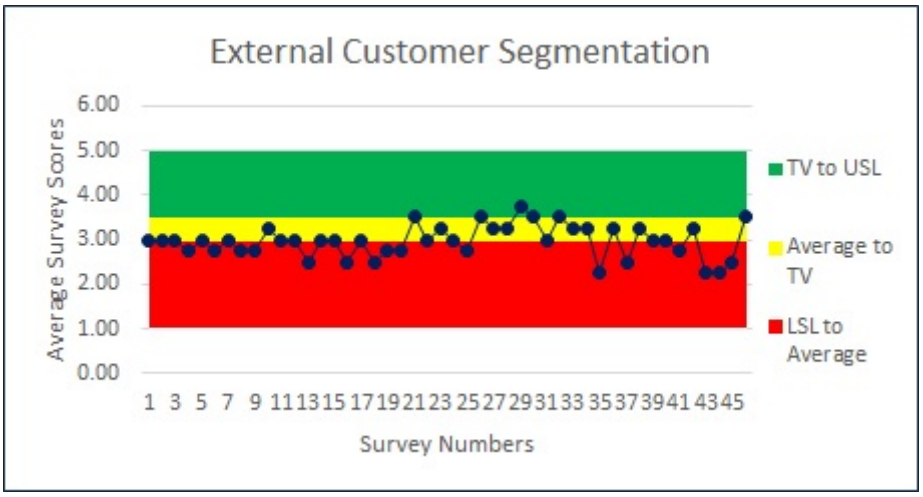


Figure 5.2: **External customers' segmentation based on the external survey responses**

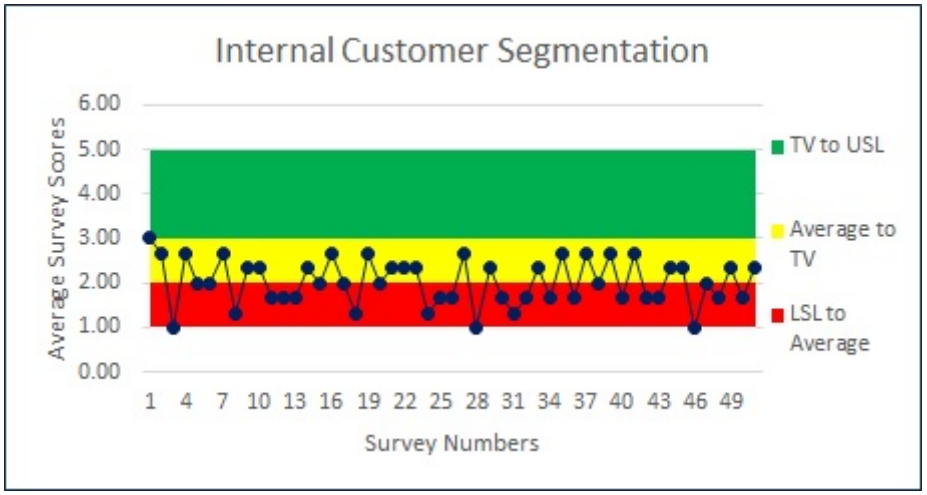


Figure 5.3: **Internal customers' segmentation based on the internal survey responses**

Blocks of colour are used to indicate the areas between the Specification Limits, the Target Value

(TV) and the overall CS scores. The areas are used to segment the customers based on their individual CS scores. The green area on the chart spans from the TV to the Upper Specification Limit (USL), the yellow area spans from the calculated overall average CS score (Figures 5.1b and 5.1c) to the TV and the red area spans from the Lower Specification Limit (LSL) to the overall average CS score.

The top line of the green area is the USL that was chosen to be 5 as it is the highest score that can be achieved from the model. Its counterpart is indicated as the bottom line of the red area and set at 1 to show the USL. This limit is of greater significance than the USL in this particular case as a low score is very undesirable when it comes to CS. The top line of the red area is the overall CS satisfaction scores, 2.97 out of 5 for EXTERNAL and 2.03 out of 5 for INTERNAL. The top line of the yellow area shows the TV for each of the types of customers.

It was decided that the TV for the EXTERNAL CUSTOMERS should rather be at 3.5 out of 5 since the current overall score is already very close to 3. A starting point of 3 was established for the INTERNAL CUSTOMERS since the overall score is so low to start off with. The function for the TV is to facilitate the formulation of improvement strategies, such as explained in Figure 1.4.

From these line charts the following customer segmentation can be done:

1. **Critical customers:** The scores that fall in the **red** area on the chart can be seen as critical customers and need the most attention. The engagement strategies required to improve those customers' perceptions and emotions, towards the CSC, include personal contact with the customers and severe corrective actions on the CSC's part. Everything that should not be done can be learnt from the root-cause analysis interactions with these customers. The "bad habits" of the CSC can be identified and corrected from the interactions.

2. **Stable customers:** The customers' scores that fall in the **yellow** area of the chart can be considered as the stable customers. The ideal would be to improve their perceptions and emotions, even more, to yield a higher CS score. It is important to remember that the stable customers would be upset if a perception of a lack of attention is created simply because they are "stable".

3. **Healthy customers:** These customers (with CS scores falling in the **green** area) are the most positive about the business function. Meaningful elicitation interactions with them can shed light on what exactly they appreciate about the business function's manners. The positive points can then be used to improve the other segments' perceptions and satisfaction scores. An important aspect to keep in mind for the customers in this segment is that they should be taken care of and never neglected. This opens up the possibility to appoint resources to focus specifically on these customers, much like a Key Account Manager would from a sales perspective.

Figure 5.4, the Pareto chart, follows with the frequency of groupings from the INTERNAL CUSTOMERS' reasons on the surveys. It was found that only six of the 19 reasons cause 80% of the dissatisfaction of the INTERNAL CUSTOMERS. Reasons A5, C3 and D2 were the reasons given most frequently by the INTERNAL CUSTOMERS. From the codification the three most common reasons are the agents' weak oral skills over the phone, the perception that the service the CSC delivers is ineffective and that the INTERNAL CUSTOMERS don't want their incoming calls to be transferred to them. These three groupings will have to be the focus of a potential improvement strategy. The reasons

given least frequently are A2 (Incomplete resolution), A9 (Impatience) and A10 (Indifference), which means that these reasons will not enjoy preference while an improvement strategy is formulated.

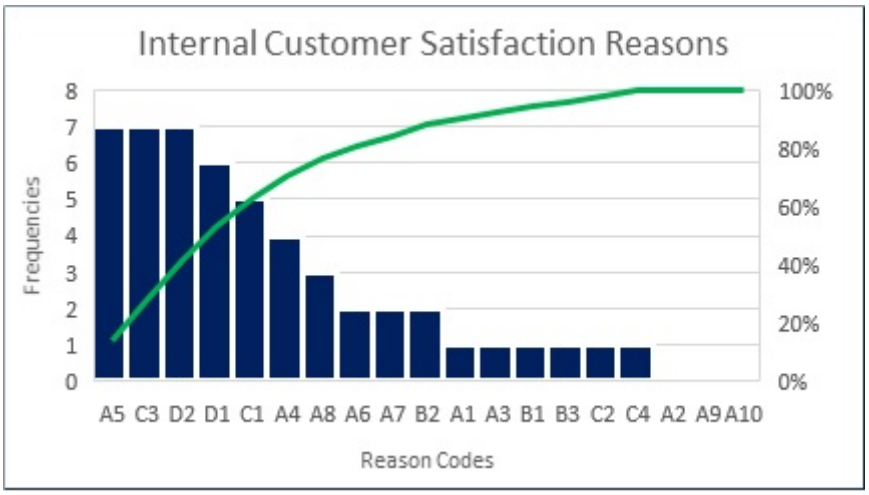


Figure 5.4: **Internal customers' segmentation based on the external survey responses**

The six charts in Figure 5.5 are the Pivot Charts relating to the Pivot Tables from the exported Customer Relationship Management (CRM) reports. Table 5.1 contains the interpretations of the results shown in the CRM Pivot Charts. All of these charts are also included on the PM dashboard.

The use of dashboards has become attractive and popular due to their ease of use. Representing data visually, rather than in a tabular format, makes the data easier to digest and makes decision-making more informed and quicker. The complete designed dashboard for the PTSI CSC is included as Figure 5.6. The business function can ultimately utilise the designed dashboard to measure its CS and overall performance.

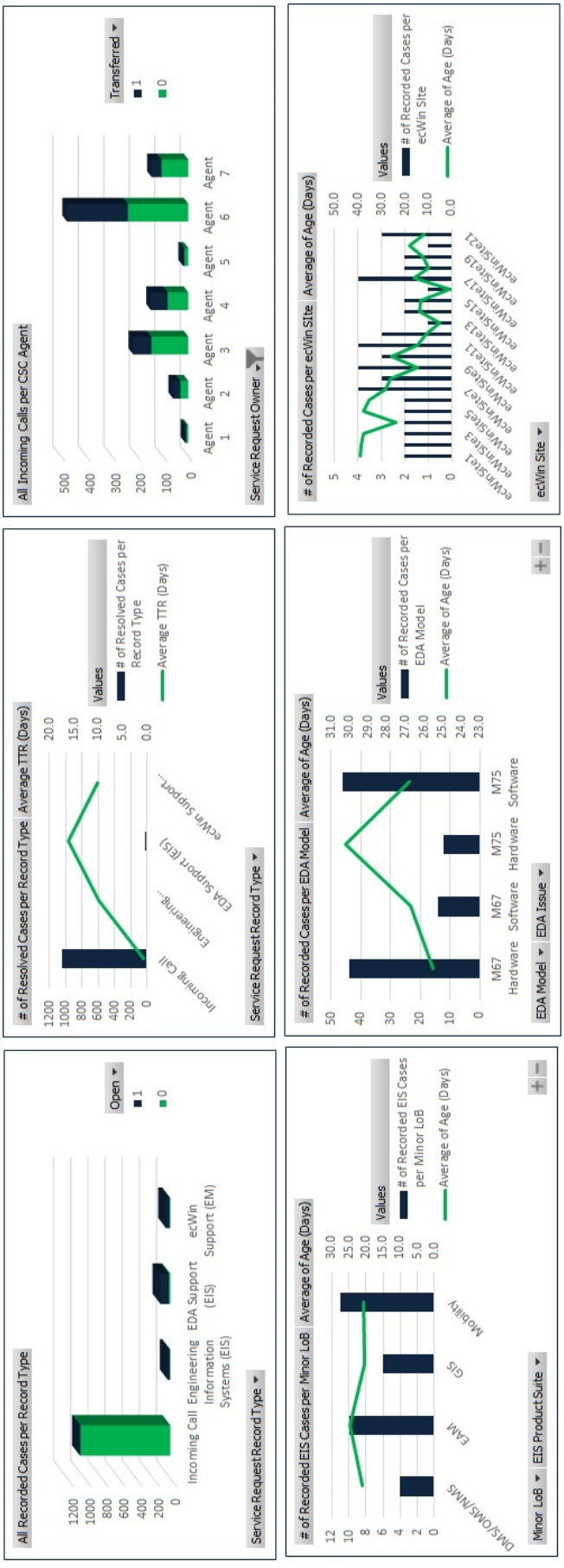


Figure 5.5: **Pivot Charts of the CRM report outputs**

Table 5.1: **Interpretations of results from the CRM Pivot Charts**

Chart Title	Location	Purpose	Results and Interpretation
All recorded cases per Record Type	Top left	To measure the number of recorded cases for every Record Type and determine where the most support is needed	The Record Type other than the Incoming Calls that needs the most support is the EDA Support Record Type. Effective resource planning and skills improvement are important aspects to consider in this case.
Number of resolved cases per Record Type and average TTR	Top middle	To measure the number of resolved cases for every Record Type and determine how long the TTR is	The average TTR is 1.1 days. As no internal SLA is followed this is an overall measurement, which is not truly representative of the functions that the CSC fulfil. An internal SLA per Record Type should be considered.
All incoming calls per CSC Agent	Top right	To measure the efficiency of the CSC agents when calls come into the CSC	The most effective call-taker is Agent 6 followed by Agent 3. Utilising these agents as primary call-takers and the others for other support functions could be considered.
Number of recorded EIS cases per Minor LoB and average TTR	Bottom left	To measure the EIS support cases' TTR	The Minor LoB with the most incidents is Mobility, however the highest average TTR, at 24.7 days, is the EAM cases. This might be due to the complexity of the EAM support calls.
Number of recorded EDA cases per EDA model and average TTR	Bottom middle	To measure the EDA support cases' TTR	The EDA Model with the most incidents is the M75's Software, however the highest average TTR, at 30.3 days, is the M75's Hardware cases. This might be due to the scarcity of the M75's spare parts.
Number of recorded ecWin cases per ecWin site and average TTR	Bottom right	To measure the ecWin support cases' TTR	The ecWin sites with the most incidents are Sites 7, 9, 11 and 17, however the highest average TTR, at 39 days, takes place at Site 1. This might be due to the complexity of the site's support calls.

Figure 5.6: **The CSC PM system dashboard**

5.2 Scenario analysis

When statistical models that contain independent and dependent variables are developed, it becomes important to determine the behaviour of the variables within a set of scenarios and compare them to some key predictions (Suganthi and Jagadeesan, 1997). A sensitivity analysis is thus conducted by using a range of variables to test the outcomes of the models.

While a sensitivity analysis focuses on the behaviour of a specific range of independent and subsequently dependent variables, a scenario analysis focuses on a possible scenario with a set of conditions, made up of the variables, that align with that scenario. A good example is a scenario of where a market might crash and what would happen to an investment model if that set of conditions take place (Investopedia, 2005).

In this application, a scenario analysis would provide valuable insights into how adaptable and scalable the customer feedback models are if the models were to be taken through a few extreme scenarios and compared to base scenarios.

Seeing as the Margin of Error and confidence level are an indication of how well the sample size represents the population, a conclusion can be drawn from various possible scenarios as follows: The smaller the Margin of Error and the higher the confidence level of the customer feedback models, the closer the sampled customers' satisfaction represents the satisfaction of the entire population of customers. In order to achieve this closeness of the sampled customers' satisfaction to the entire population's satisfaction, the sample sizes are required to be significantly larger. In other words, the Margin of Error is indirectly proportional to the sample size and the confidence level is directly proportional to the sample size. This aspect can positively contribute to the scalability of the customer feedback models.

The downside of the larger required sample sizes is that if the Response Rate (RR) were to be kept at the same level (80%), then the number of returned surveys will need to increase, as well. This will pose a challenge, because of the non-response biases surrounding CS surveys currently experienced in the market (Brogle, 2014).

Another downside would be the financial impact that the larger sample size will have on the business. A larger sample size means more surveys are required and more human resources are required to conduct said surveys. The time for the processing of the larger number of surveys will also increase. The increased need for resources will have a negative impact on the budget set out for measuring CS, should one be made available.

Furthermore, it could be of value to determine how much certain values need to change to obtain a satisfactory CS score. In other words, it could be useful to determine what needs to change in the responses of customers to minimise the yellow area on the customer segmentation charts. The area will shrink if the overall average CS score increases and moves closer to the TV. It would be counter-intuitive to lower the TV closer to the average score or to have a TV if the overall score is above it. The optimal scenario would be to have an overall CS equal to the TV to validate the hypothetically completed improvement initiatives, and then to set a higher TV with more improvement initiatives for the coming period.

By referring to PTSI's current customer segmentation results, it can be determined that the overall EXTERNAL CUSTOMERS' satisfaction scores would need to improve by 15% across the board, to reach

the current TV that is set at 3.5 out of 5. For the INTERNAL CUSTOMERS' overall score to match the current TV of 3 out of 5, an overall improvement of 32% is required. The required improvements should be included in the business function's strategy and translated into goals, objectives and activities to include in the PM system.

5.3 Testing the solution against the solution requirements

In order for a solution to be relevant and effective, it should be validated. The validation of a solution can easily be done if a set of solution requirements have been identified, clarified and stated as guidelines for the design and functioning of the solution. Table 5.2 shows that the solution requirements identified in Section 1.7 were addressed during the design of the PM system.

Table 5.2: The validation of the designed solution

	Solution Requirement	Requirement Addressed?	How?
1	Define the current communicative interactions between EXTERNAL CUSTOMERS and the CSC and INTERNAL CUSTOMERS and the CSC	**Yes**	The communicative interactions were defined and processed into a business process using BPMN and can be found in Section 3.2
2	Determine and state the most appropriate approach to customer feedback tools for both EXTERNAL CUSTOMERS and INTERNAL CUSTOMERS	**Yes**	Surveys were identified as the most appropriate and applicable customer feedback tools in Chapter 2
3	Identified feedback tools must be simple, descriptive, cost effective, time saving and statistically significant	**Yes**	Statistical analysis methods were found to work well with customer feedback surveys and is explained in Section 2.2.3
4	The design of the identified customer feedback tools should conform to the above mentioned attributes	**Yes**	The justification of the chosen survey questions can be found in Section 3.4
5	A mathematical model is required to capture and interpret the results of the feedback tools	**Yes**	Refer to Section 4.2 for the models for both EXTERNAL AND INTERNAL CUSTOMERS
6	The significance of the customer feedback tools in the measuring of performance of the CSC must be determined and stated	**Yes**	This requirement was addressed in Section 2.3.1
7	An appropriate performance measurement tool for the CSC must be identified, stated and designed	**Yes**	Refer to Section 4.3 for the designed performance measurement system
8	The identified performance measurement tool must effectively and accurately use the outputs of the customer feedback tools as inputs	**Yes**	By the use of hyperlinks within Excel the outputs of the customer feedback tools can be accessed
9	The designed tools and models must be made available in a program that is familiar to the end users	**Yes**	After considering a few alternatives, it was decided that Microsoft Excel will be used mainly because the end users of the tools are so familiar with the program
10	All the designed tools should be able to stand up to a validation exercise to prove the relevance and effectiveness of the solution	**Yes**	The scenario analysis and the solution validation table prove the relevance and effectiveness of the solution

Chapter 6

Conclusion

6.1 Outcomes

The goal of this project was to develop a uniform customer feedback tool for both EXTERNAL CUSTOMERS and INTERNAL CUSTOMERS of Powertech System Integrators (Pty) Ltd (PTSI) to feed into a developed performance measurement system in order to determine the effectiveness and productivity of the Customer Support Centre (CSC) with regard to Customer Satisfaction (CS).

From the literature studied it was found that surveys are used to collect customer feedback, regardless of whether the customers are internal or external. It was also found that there are tested and widely accepted survey questions already available to collect specific feedback. The designs of the surveys must consider the target population along with what exactly the business wants to learn from distributing the surveys and the costs thereof. The results from the surveys were analysed with statistics to ensure the significance, accuracy and validity of the outputs. It was found that the metric of CS form part of the most important metrics used to measure the performance of call centres.

By using Industrial Engineering tools and techniques, models were developed to process the results of the surveys and those outputs were used as inputs for the Performance Measurement (PM) to measure the efficiency of the CSC of PTSI. The models were built in Microsoft Excel, because of the users' familiarity with the program and its calculating powers. The models were validated by using a scenario analysis, but not implemented in the business.

It was found that the external and internal CS is far less than desired and that serious improvement initiatives should be put in place for the CS scores to improve. The specific areas identified from the INTERNAL CUSTOMERS' reason groupings further indicate that multiple improvement opportunities exist.

The unsatisfactory CS scores have a business, financial and cultural impact on the business function (the CSC). From a business perspective, it can indicate that the possibility of repeat communications could be slim. This is a detrimental blow to the business because repeat business with current customers is not as resource intensive as it would be to acquire new customers from scratch. Also, fewer opportunities will be generated by the EXTERNAL CUSTOMERS' connections, due to unsatisfactory services received while in contact with the CSC.

The financial implications could include not only the lost opportunities but also the extra training that the CSC staff will have to receive to improve on the aspects identified as lacking. Another

financial implication could be the need for financial incentives to motivate the agents to improve their service levels.

The cultural implication of the unsatisfied customers, especially the INTERNAL CUSTOMERS, could lead to demotivated CSC agents, which could have a detrimental effect on the interactions they have with the EXTERNAL CUSTOMERS.

Viewing the bigger picture, the aspect of unsatisfied customers could overshadow the engineering excellence and expertise that PTSI provides to the customers. It could also then damage the long-standing relationships that the business has already built over the years.

6.2 Recommendations

6.2.1 Recommended use of the designed PM system

Should PTSI wish to continue competing in a customer-driven global market, the business should urgently reconsider the approach that its CSC takes to customer service. By using the solution developed a process of continuous improvement can be developed. Figure 6.1 displays the recommended steps to take in the future use of the PM system to facilitate a continuous improvement in the CS of the CSC of PTSI.

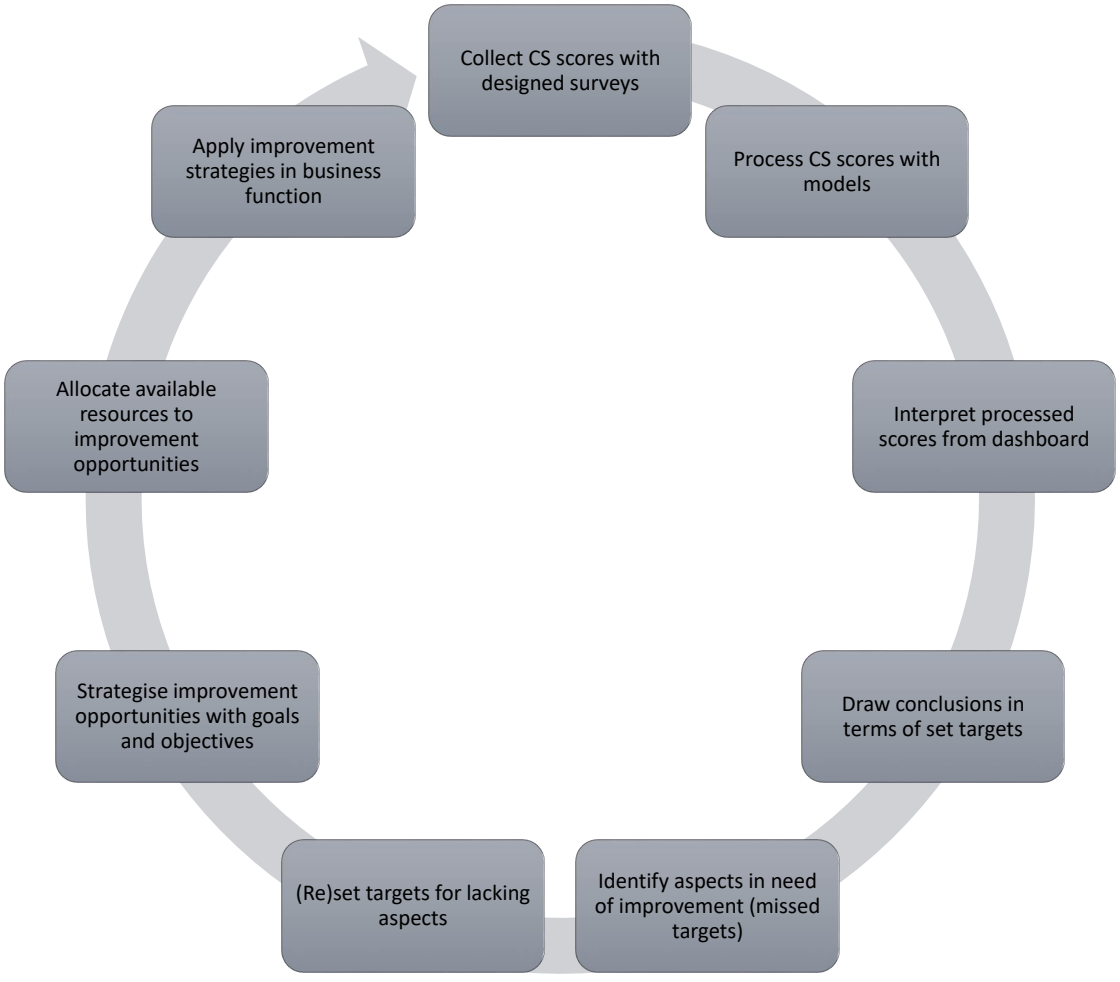


Figure 6.1: **Recommended use of PM system from a continuous improvement approach**

In Section 5.2 a conclusion was drawn that the EXTERNAL CUSTOMERS' satisfaction should be improved by 15% and the INTERNAL CUSTOMERS' satisfaction by 32% to match their respective Target Values (TV's). Specific aspects that require improvement can now be pinpointed as stated in the continuous improvement cycle (Figure 6.1). A good place to start would be to determine which customers' survey responses are primarily responsible for the responses that occupy the red area on the customer segmentation charts and centre a customer service recovery strategy around them. This is made possible by the fact that various customers from various sectors are recorded within the models (Figures 4.5 and 4.6).

After a customer service recovery strategy has been decided upon, aspect specific targets along with goals and objectives for any improvement opportunities can be set. Finally, the required resources can be allocated to apply the strategy. The validation of the strategy and the improvements will happen when the following period's CS scores are collected and processed.

6.2.2 Customer service recovery

Major companies such as the JetBlue (US airline) and the Walt Disney Company have customer service recovery approaches because it was found that back-end recovery can often be more cost effective than upfront prevention (Markidan, 2014).

These approaches include steps such as:

- Hear: Listen to the grievance of the customer and acknowledge that the fault has occurred;
- Empathise: Acknowledge the customer's emotions regarding the fault that occurred;
- Apologise: Apologise for the fault occurring and explain the reasons for the fault;
- Resolve: Resolve the fault as quickly as possible after asking the customer what he/she would consider an adequate resolution;
- Make good: Provide compensation to the customer should the severity of the fault require it and
- Diagnose: After the fault has been resolved to the customer's satisfaction it is necessary to investigate the fault and find out why it occurred.

It is recommended that PTSI invest in a customer service recovery strategy in order to retain loyal customers and to save money.

6.2.3 Additional recommendations

A pertinent recommendation can be made towards retraining and improving the CSC agents' skills overall. This could be considered as an elementary improvement in the pursuit of improved CS scores for the business function.

To improve discipline within the business function, the implementation of a clear and achievable internal Service Level Agreement should be investigated and considered.

Another recommendation will be the facilitation of a culture change across the entire business to shift the business focus to a customer-centric focus. This culture change will have to include an

understanding of the importance of rekindling older customer relationships and actively fostering the current relationships from the other business functions' side. These relationships will then have to be reinforced by effective and complete service from the CSC.

A clear vision for the growth of the business will assist the CSC to align its goals, objectives and activities more effectively and will then become more effective when the business function understands where it fits into the overall picture of the business's future.

6.3 Future work

Although this project has enabled the CSC to measure and analyse the CS of their customers, some future work has been identified.

6.3.1 Automated customer feedback tool

An automated solution for the measuring of the CSC's CS scores and performance could also be investigated as such a solution could potentially streamline the measuring process and freeing up the agents' time to focus on the customers' needs.

An example of such a solution would be the automatic distribution of emails asking to rate the service straight after contact with a customer. Or, as in the case of Vox Telecom, an extra interactive section is added to the email signature of each employee to enable a customer to rate that employee's service directly from the email.

6.3.2 Real-time measuring of CS

An argument can be made for the real-time tracking of CS in the CSC because it will enable the business function to react quicker to undesired CS scores. Such a solution would have to have a much more detailed approach towards the specific dissatisfaction of the customers on a more immediate timeline.

A scenario where a real-time tracking solution could be beneficial could be where an email response is required to rate the service of the CSC and the rating that is received is a negative rating. The immediate monitoring of such responses along with the immediate corrective actions that could be taken could potentially turn such a negative rating into a more positive rating.

Such a solution might require significant capital expenditure, which means that an effective Return-on-Investment exercise will be required to show that it would be financially beneficial to the business.

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Appendix A

Telephonic survey script

Surveyor: "Good day. My name is Celeste and I am calling from Powertech System Integrators (Pty) Ltd (PTSI). You have been in contact with our Customer Support Centre (CSC) lately. Do you have a few minutes to answer a few survey questions regarding the quality of your interactions with our agents?"

Customer response 1: Negative

Surveyor: "Thank you for your time. Powertech System Integrators hope to hear from you again soon."

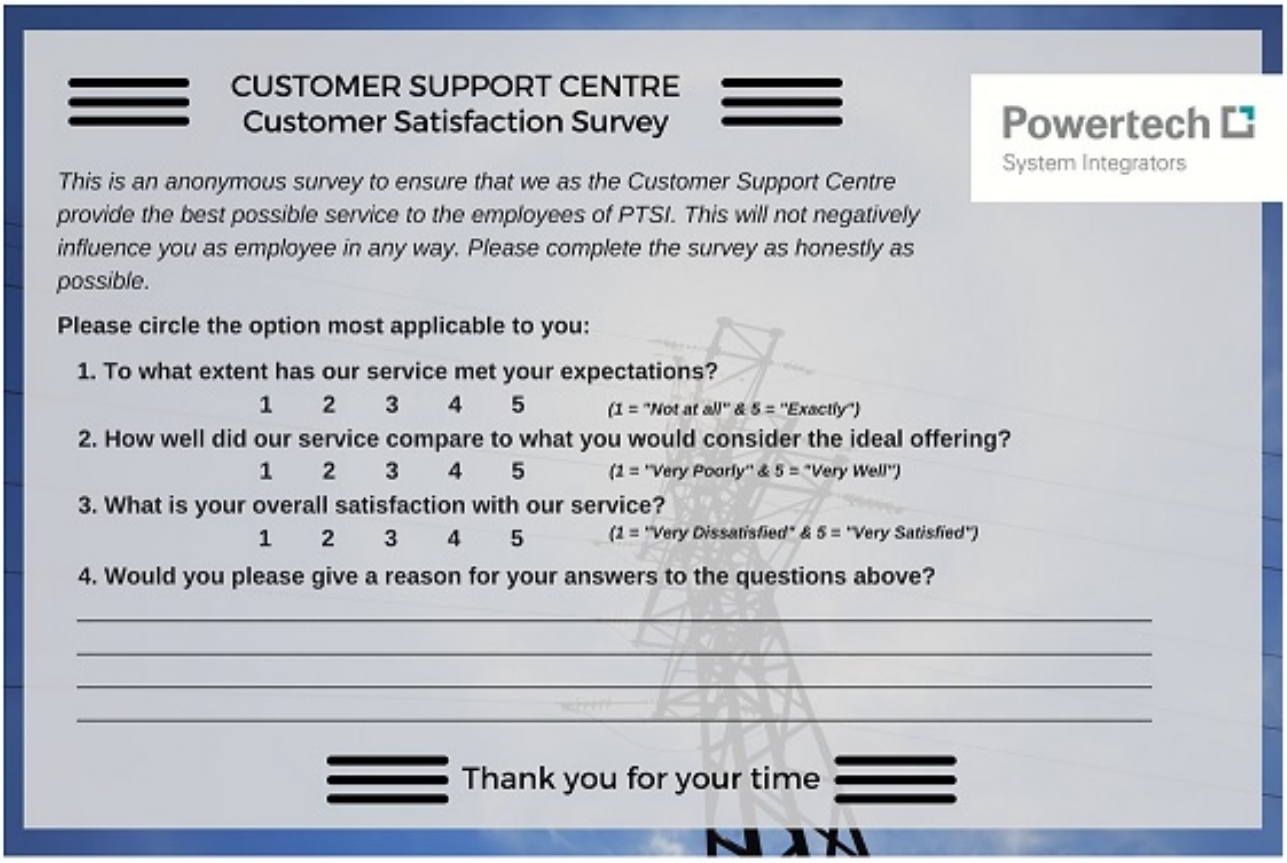
Customer response 2: Positive

Surveyor: "Please note that you are welcome to discontinue anytime you wish. Please answer the following questions on a scale of 1 to 5 where 1 refers to the negative and 5 refers to the positive."

*** Ask the four survey questions and record the answers ***

Surveyor: "Thank you for your time. Powertech System Integrators hope to hear from you again soon."

Detailed internal survey design



CUSTOMER SUPPORT CENTRE
Customer Satisfaction Survey

Powertech
System Integrators

This is an anonymous survey to ensure that we as the Customer Support Centre provide the best possible service to the employees of PTSI. This will not negatively influence you as employee in any way. Please complete the survey as honestly as possible.

Please circle the option most applicable to you:

1. To what extent has our service met your expectations?
   1 2 3 4 5 *(1 = "Not at all" & 5 = "Exactly")*
2. How well did our service compare to what you would consider the ideal offering?
   1 2 3 4 5 *(1 = "Very Poorly" & 5 = "Very Well")*
3. What is your overall satisfaction with our service?
   1 2 3 4 5 *(1 = "Very Dissatisfied" & 5 = "Very Satisfied")*
4. Would you please give a reason for your answers to the questions above?

Thank you for your time

Appendix B

Performance Measurement (PM) system home page

X Requires immediate attention
Δ Requires special attention
O Maintain activity at this stage

Powertech System Integrators

M&BD A3 (2016/17) - Period: July 2016

Owner: CSC Manager **Date:** 31/07/2016

LoB Goal	Business Function Goal(s)		Business Function Objectives	KPA / Measure		Business Function Activities (Current Period)	Status	DUE DATE		Business Function Activities (Next Period)
Provide impeccable customer service as a business	Provide customer service of such high quality that the business as a whole benefits	1	Measure customer satisfaction of external customers	Overall External CS Score	1				1	
		2	Measure customer satisfaction of internal customers	Overall Internal CS Score	2				2	
		3	Segment customers to determine engagement strategies	External and Internal satisfaction	3				3	
		4	Determine causes of dissatisfaction of customers	Internal Customer Satisfaction Reasons	4				4	
		5	Identify corrective actions for the determined causes		5				5	
		6	Identify improvement opportunities directly linked to the determined causes		6				6	
		7	Identify general improvement opportunities for the CSC		7				7	
		8	Respond to customer complaints (external and internal)		8				8	
		9	Track success of engagement strategies and improvements for continuous improvements		9				9	
		10			10				10	
	Provide high quality first-tier support for specified solutions provided to PTSI customers by the LoBs	1	Measure # of cases recorded per SFDC Record Type on a montly basis	# of Recorded Cases per Record Type	1				1	
		2	Measure # of cases resolved per SFDC Record Type on a montly basis	# of Resolved Cases per Record Type	2				2	
		3	Monitor the average time to resolution of cases	Average TTR of Resolved, ecWin, EDA and EIS Cases	3				3	
		4	Determine causes for unresolved cases		4				4	
		5	Identify applicable corrective actions of the determined causes (if because of CSC)		5				5	
		6	Identify improvement opportunities for the first-tier support provided by the CSC		6				6	
		7	Measure PABX Service levels	PABX Service Level	7				7	
		8			8				8	
		9			9				9	
		10			10				10	

Appendix C

Industry sponsorship forms

Department of Industrial & Systems Engineering
Final Year Projects
Identification and Responsibility of Project Sponsors

Final Year Projects may be published by the University of Pretoria on *UPSpace* and may thus be freely available on the Internet. These publications portray the quality of education at the University, but they have the potential of exposing sensitive company information. It is important that both students and company representatives or sponsors are aware of such implications.

Key responsibilities of Project Sponsors:

A project sponsor is the key contact person within the company. This person should thus be able to provide guidance to the student throughout the project. The sponsor is also very likely to gain from the success of the project. The project sponsor has the following important responsibilities:

1. Confirm his/her role as project sponsor, duly authorised by the company. Multiple sponsors can be appointed, but this is not advised. The duly completed form will considered as acceptance of sponsor role.
2. Review and approve the Project Proposal, ensuring that it clearly defines the problem to be investigated by the student and that the project aim, scope, deliverables and approach is acceptable from the company's perspective.
3. Review the Final Project Report (delivered during the second semester), ensuring that information is accurate and that the solution addresses the problems and/or design requirements of the defined project.
4. Acknowledges the intended publication of the Project Report on UP Space.
5. Ensures that any sensitive, confidential information or intellectual property of the company is not disclosed in the Final Project Report.

Project Sponsor Details:

Company:	Powertech System Integrators (PTSI)
Project Description:	Measuring and analysing internal and external customer satisfaction in a multidisciplinary engineering company
Student Name:	Celeste Visagie
Student number:	04430506
Student Signature:	
Sponsor Name:	Debbie Pitout
Designation:	Customer Support Centre Manager
E-mail:	debbie.pitout@ptsi.co.za
Tel No:	(012) 426 7248
Cell No:	084 555 6108
Fax No:	
Sponsor Signature:	

Department of Industrial & Systems Engineering
Final Year Projects
Identification and Responsibility of Project Sponsors

Final Year Projects may be published by the University of Pretoria on *UPSpace* and may thus be freely available on the Internet. These publications portray the quality of education at the University, but they have the potential of exposing sensitive company information. It is important that both students and company representatives or sponsors are aware of such implications.

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1. Confirm his/her role as project sponsor, duly authorised by the company. Multiple sponsors can be appointed, but this is not advised. The duly completed form will considered as acceptance of sponsor role.
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4. Acknowledges the intended publication of the Project Report on UP Space.
5. Ensures that any sensitive, confidential information or intellectual property of the company is not disclosed in the Final Project Report.

Project Sponsor Details:

Company:	Powertech System Integrators (Pty) Ltd
Project Description:	Measuring and analysing internal and external customer satisfaction in a multidisciplinary engineering company
Student Name:	Celeste Visagie
Student number:	04430506
Student Signature:	
Sponsor Name:	Hannes Snyman
Designation:	Executive: Business Development
E-mail:	Hannes.Snyman@ptsi.co.za
Tel No:	012 426 7545
Cell No:	
Fax No:	
Sponsor Signature:	