Improvement of the procurement of medical supplies and applications of technology in the rendering of Forensic Pathology services

by

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Executive Summary

The Gauteng Forensic Pathology services have always and will continue to play a major role in the investigation and solving of unnatural deaths. Highly trained professionals work around the clock to keep up with the vast amount of cases and unnatural deaths that needs to be investigated throughout the province. While systems and processes are in place they have not been investigated from an engineering perspective and seem to have a lot of potential problems and or inefficiencies. Coupling this with the crime rate spiraling out of control, government mismanagement, and a police service that is not up to standard, it is clear that the emphasis on these investigations must be to work towards optimal efficiency.

The main project consists of 3 parts. These parts include the following:

- The development of a central warehouse management system
- Business Intelligence, coupled with forecasting, technology and software to help the central warehouse manager with the receiving and shipping of items
- Technological applications that can be applied within the Forensic Pathology Services

Extensive research was done in order to obtain the actual problems as well as possible solutions. It was found that there are currently no warehouse management systems in place. This led to an unorganized and inefficient central warehouse. Different areas were looked at and suggestions, including a new layout, were made.

A simple moving average forecasting method was used to help the manager with the procurement of items. Software was also used to enable the warehouse manager to present the data to the management board in such a way that the performance of the warehouse and the relevant items could be used to make valuable decisions.

With regards to the technological applications, RFID and bar coding technology were looked at. It was found that bar coding is the best choice, with regards to my project, and that it could be implemented in 2 areas:

- Inventory management within the central warehouse
- Police data filing system

A complete bar coding system that only costs R35700 is suggested. This system will ensure that the warehouse manager obtains complete control of the central warehouse and its various items. Implementing bar coding technology, together with a central database, will increase the efficiency and accuracy of investigations.
All of the previously mentioned suggestions and recommendations could make an extensive impact towards ensuring that the Gauteng Forensic Pathology Services continue to strive to serve the public in the best possible way
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1 Introduction and Background

The law states that every death must be investigated. This is done to determine and confirm whether the death was natural, accidental, homicide, or suicide. Forensic medical services are used to determine these deaths. Of specific interest to the public and family members is the cause of unnatural deaths.

Forensic medical services in South Africa are rendered by state-employed forensic pathologists and district surgeons. In conjunction with the South African Police Service, forensic pathologists’ services are used to determine the cause of an unnatural death.

With South Africa's homicide rate so extremely high and with public pressure mounting with each unsolved case, it is of the utmost importance that the correct systems and procedures is in place during these complex investigations so that the people responsible can be brought to justice. The systems and technology currently being used by medical legal investigators in Gauteng is out of date and disrupting the efficiency of investigations. Problems include: medical inventory management and procurement of expendable medical items, lack of an adequate amount of staff, and a lack of computer systems keeping track of the overall investigation.

During problem investigation it became apparent that there are a lot of problems that needed to be looked at. Although with limited time and resources available for this project, certain problems needed to be identified, studied, and then finally resolved.

The problems identified were:

- Medical inventory management and procurement of expendable items (incl. forecasting and software applications)
- Technological applications

This project focuses on these 2 problems, with specific emphasis on the medical inventory management and procurement of medical expendable items.

Following a decision taken in parliament in 1998, all mortuaries under the control of the South African Police Service where transferred to the Department of Health in April 2006. Since the transfer all facilities within the Department of Health were responsible to procure all of their medical expendable items through the Medical supplies depot (MSD). However, the Medical supplies depot are primarily used to supply state hospitals with the necessary items needed for daily operation, and not the medical expendable items that are needed (by forensic pathologists, coroners, medical examiners, and cleaners) when conducting a medical investigation. The problem with this system was that the MSD didn’t always stock all of the necessary items needed, and the items that were in stock weren’t always up to standard (quality). The items that were not in stock,
had to be procured through a quote basis. Three Quotes had to be obtained by approved suppliers, which in turn had to be sent to the Gauteng Shared Services, which handles the finances, for approval. It is easy to see why this was not an optimal system and that an alternative had to be looked at. This is why the new central warehouse is considered so important.

When looking at the technological applications, it became apparent that there are, quite literally, no technological applications that are used to assist with the investigations.
2 Project Aim

The aim of this project is to evaluate the overall investigative process currently being used in the medico-legal investigation of death, in order to optimize, standardize and streamline this process through the improved application of technology and process administration. Specifically, the use of such applications in order to effect cost saving measures and to enhance overall quality. It should be noted that there is currently very little standardization of the medico-legal investigative process, with various provinces and individual mortuaries often employing locally developed systems and procedures, often under the managerial and supervisory control of medical and other individuals who may not be fully aware of the principles and practices of industrial process control. Not only does this result in inefficient and suboptimal application of resources, but in many cases may well compromise the efficient medico-legal investigation and in consequence, the ultimate legal proceedings associated with such cases.

Another objective is to implement a warehouse management system (WMS) for the new central warehouse. This warehouse supplies all of the morgues situated in Gauteng with the necessary medical expendable items (and other general medical related items). Together with forecasting and software applications, as well as technological applications, an efficient warehouse can be created.
3 Project Scope

Considering the vast amount of technology available, including those that are currently being used in the medical field, extensive research was done to determine the various technologies that can be practically applied to facilitate the Forensic Pathology services. RFID technology and Bar coding technology (discussed in the literature review) was identified and researched. The financial feasibility is vaguely discussed and if the Department considers the project to be implementable, more research will need to be done to determine the financial impact of the proposed solutions and recommendations.

The research in obtaining the correct central warehouse is included. The situation of the current central warehouse is looked at from all perspectives in order be able to design solutions and ultimately to be able to make recommendations.

Software that is able to help with the warehouse management was identified and used to show the implications and benefits the software will have.
4 Chapter 1: Literature Study

4.1 Forensic Pathology services

The Inquests Act (Act number 58 of 1959) states that all non-natural deaths must be reported to the South African Police Services, who are then obliged to investigate such deaths. As part of such investigation, the body of the deceased must be examined by a medical practitioner, with a view to establishing the cause of death. All developed countries have well defined systems and legal frameworks for the medico-legal investigation of death, to facilitate the administration of justice, with reference to criminal and civil legal proceedings which may follow in such cases, as well as to ensure conclusion of appropriate administrative services attendant to death (issuing of death certificates, administering the process of burial or disposal of bodies, alteration of details in population registers, insurance policy/pension payouts, statistical services, etcetera).

Deaths of individuals can primarily be classified into those that are the result of natural causes and those that are due to other than natural causes. Other than natural deaths are defined to include the following:

- those that are the result (direct or indirect) of physical or chemical influence on the body
- where death is the result of an act of commission or omission, on behalf of a party where there was a duty to act
- deaths that take place specifically as a result of or due to medical treatment / surgical procedures
- sudden and/or unexpected deaths, where the cause of death is not initially apparent

All deaths are further classified into one of the following categories, commonly referred to as the “manner of death”: homicide, suicide, accident, natural or undetermined. It is the responsibility of the South African Police Services, to investigate all deaths due to homicidal, suicidal or accidental cause and circumstance. In cases where evidence of criminal activity in the causation of the death of an individual is demonstrated, the matter is referred for further management by the Director of Public Prosecutions, who will institute criminal proceedings, where appropriate. Deaths that are the result of suicide or accident, generally reside under the provisions of the Inquests Act, with the presiding judicial officer (inquest magistrate), concluding the proceedings by making formal findings pertaining to the identity of the deceased, the date and place of death, the medical cause of death and whether any other individual may be held criminally liable for the death.
South Africa has one of the highest non-natural death rates in the world, due to the exceptionally high incidence of homicide, large numbers of road traffic fatalities and an increasing suicide rate, to name but a few causes. Approximately 70,000 medico-legal autopsy examinations are conducted annually in South Africa, as part of the abovementioned legally prescribed investigative processes. Such medico-legal investigations are rendered by the provincial Departments of Health, through their Forensic Pathology Service components. All magisterial districts are served by one or more medico-legal mortuary, where the bodies of deceased individuals (who require medico-legal investigation) are admitted and stored and subsequently examined, in terms of the Inquests Act.

The Pretoria Medico-Legal Laboratory (mortuary) (PMLL) serves the greater Pretoria/Tshwane metropolitan area, with two further mortuary facilities (respectively positioned in Bronkhorstspruit and Garankuwa) servicing the rest of the northern part of Gauteng Province. In total, some 4,500 medico-legal autopsy investigations are carried out at these three facilities, with 2,500 of these being done at the PMLL. In the rest of Gauteng, a further 12,000 such cases are investigated annually, at eight other mortuaries placed across the more southern areas of the province.

Over the past 50-100 years, there has been an explosion in the application of science and technology in the medico-legal investigation of death. Such scientific and technological applications now include advanced toxicological analysis (to include chromatography, mass spectrometry, bio-assays, etc), ballistic fingerprinting, bloodstain pattern analysis, footprint and other tool mark analysis, statistics and computational forensics, anthropology and many other applications.

Accurate statistics are difficult to obtain, partly due to the moratorium and restrictions placed from time to time, on the availability and publication of such information by the South African Police Services. However, it is estimated that more than 20 000 homicides/murders take place annually in South Africa. Furthermore, accidental deaths due to road traffic accidents and in the workplace, as well as suicides which are unwitnessed, may require intense investigation and reporting. When regard is taken for the full spectrum of resources required in the subsequent investigation of such deaths as well as the legal processes which follow thereupon, it is clear that there will be enormous capital cost to society, in relation to the investigation of unnatural deaths.

### 4.1.1 Scope of a Medico-legal investigation

The full scope of a medico-legal investigation of death service comprises the following components:

- Collecting the body of the deceased from the crime / death scene and obtaining appropriate and relevant (preliminary) information pertaining to the death. Where
necessary and appropriate, evidentiary material (e.g. medication or drug paraphernalia), will be collected and preserved by the forensic pathology auxiliary service officer, or by the pathologist / medical practitioner who attends the death scene.

- Performing a medico-legal autopsy examination (with a view to inter alia, identifying, recording and harvesting appropriate evidentiary material, establishing or confirming the identity of the deceased, providing a full description of injuries and/or diseases which may be present, etc.)

- Performing relevant and appropriate special investigations on the body or components thereof, such as toxicological analysis of body fluids, histological (microscopic) evaluation of organ or tissue specimens, analysis of hair, nail or fibre components (which may be found on or within the body), ballistic examination of projectiles, forensic DNA-analysis, X-ray or other radiological examinations, etc.

- The compilation of a comprehensive technical / medical report, which may serve as objective evidence in subsequent legal proceedings and where necessary, rendering of expert oral testimony in a court of law pertaining to the findings and the interpretation thereof.

It is clear that the outcome of these investigations will hold far reaching implications for the lives of family members and friends of deceased individuals, for employers and insurance companies, for suspects and accused parties, to name but a few.

4.1.2 Financial effect of Medico-legal investigations

Conservative estimates would put the direct annual costs associated with the rendering of forensic pathology (and immediately associated scientific services), on a national basis, well in excess of a billion rand. Mortuary services alone, in terms of human and other resource requirements, account for budget allocations in excess of R600 million per annum. Every effort should thus be made to ensure optimal use of all resources in this industry, in an effort to minimize the ultimate cost to society and the taxpayer. It is essential that due attention be paid to all aspects of efficient management and business administration, as well as the appropriate use of time and resource saving technologies, not only to enhance efficiencies, but also to ensure accuracy and accountability in outcome in this important service - which is rendered by both government and private sector agencies.

4.1.3 Why do forensic pathology services need to be looked at from an engineering perspective?

In South Africa, the medico-legal investigation of death is primarily entrusted to medical practitioners, who have an interest or expertise in the field of forensic medicine. However, there are only approximately 35 practicing specialist forensic pathologists in
the country. The vast majority of medico-legal investigations are conducted by medical practitioners with no specific or formal postgraduate qualifications in the field of forensic pathology. Unfortunately, there is currently inadequate resource allocation, both from a human resource and fiscal perspective, to provide an efficient and professional service. In particular, most pathologists and/or medical practitioners involved in this field do not have a good understanding or knowledge of the industrial systems or engineering and technological applications, which may be available to facilitate and to optimize the overall investigative process extending from the “crime scene to the court room”. It is against this background, that this study is undertaken, with the view to evaluating the existing investigative practices, identifying possible opportunities for application of administrative and technological expertise in order to optimize and standardize the investigations.

4.2 Technological applications

The Merriam-Webster dictionary defines technology as: “The practical application of knowledge especially in a particular area”. Forensic Pathology services use a wide range of medical technology to assist in their investigations. However, with little engineering expertise in the medical field, it is easy to understand how certain technologies that can add extensive value towards their investigations, whether it speeds up the process and or helps in the validity of the overall investigation, can be overseen by the medical experts. The study conducted so far into the technology currently used by the Forensic Pathology services revealed relatively small “technological gaps” that are currently having an extensive effect on the department’s budget and the efficiency of operations. After extensive research it became apparent that Bar code and RFID technology is a relatively easy and inexpensive technology that can be implemented to assist the Forensic Pathology services in their investigations. These 2 different technologies will be weighed against each other to decide the best technology with regards to my project. (Wikipedia, 2010)

4.2.1 RFID Technology

Radio frequency identification (RFID), although being around for decades, is still considered one of today’s “hottest” technologies. RFID technology uses radio waves to identify items and or objects. An RFID System is composed out of 3 components: i) tags, ii) readers, iii) middleware application. The tags contain both a microchip and an antenna. The microchip stores useful data and information which are transmitted via the antenna to a reader. The reader converts the data to a language understandable by a computer. Although RFID is part of a range of technologies that includes bar coding, RFID is considered to be much more effective than bar codes. Bar codes have to be read by a “line of sight” scanner. This poses numerous problems which includes bar
codes being scraped off of the item. RFID readers only have to receive a signal from the tag to receive the information. Thus it is not as labour intensive, and is much more accurate and efficient (when scanning manually). Figure 1 shows a range of technologies (incl. RFID) and how RFID is positioned within the Automatic identification and data capture technology (AIDC) landscape. (Angeles, 2005: p51-65)

4.2.1.1 RFID Tags

RFID tags stores product information such as manufacturer, date of manufacturing, destination, expiration date etc. These tags can be active, semi-passive, or passive. Active tags use battery power to broadcast the signal to readers whereas passive tags uses the electromagnetic waves sent out by the reader to power its circuitry. Semi-passive tags uses both battery power and the electromagnetic waves sent out by the reader. The active and semi-passive tags are generally used for more expensive or higher valued goods because it can be used over longer distances. Passive tags are less expensive because these tags only use the electromagnetic waves of the reader to power its circuitry. The tags contain a chip that is either read-only or read-write. Read-only chips can only read information that was initially stored on the chips whereas read-write chips can be reprogrammed as the product moves through the supply chain. The passive tags look to be a viable option that can be used by the Forensic Pathology services. (Angeles, 2005: p51-65)
Figure 1: Positioning RFID technology in the AIDC and Wireless technologies landscape

4.2.1.2 RFID Readers
The reader uses a method called inductive coupling. This method is used to communicate with the tags. The reader’s antenna creates a magnetic field with the tag’s antenna. This causes the reader to draw energy from the magnetic field which it uses to send waves back to the reader. (Angeles, 2005: p51-65)
4.2.2 RFID uses in Forensic Pathology services

Although the RFID technology looks promising, extensive research and studies still have to be done to determine whether the technology will be financially suitable for the Forensic Pathology services. These studies will also indicate where and to what extent the technology will be needed. A problem area identified:

- Keeping track of stock in the centralized warehouse (centralized warehouse discussed later)

RFID technology will have a substantial and crucial effect on the above mentioned problem. A lot of paperwork will be eliminated and better control over data is but a couple of the advantages identified.
4.2.3 Bar code Technology

Bar coding are currently used extensively throughout the world by thousands of companies, proving their efficiency and reliability. Although bar coding are considered not as advanced as RFID technology, it is considerably cheaper to buy and to operate. Seeing as the Department of Health already struggles with their current yearly allocated budget, bar code technology is included in my literature review as a financial alternative to RFID technology.

4.2.3.1 Bar code basics

Bar codes provide an inexpensive and simple method to encode text information which in turn can be easily read by inexpensive electronic bar code readers. These readers collect data rapidly with extreme accuracy. Bar codes consist of parallel, adjacent bars and spaces. These space patterns are predefined, also known as symbologies (discussed later), and are used to encode strings of data into a symbol. Bar codes can be seen as a printed Morse code with the narrow bars representing dots, and the wide bars representing dashes. The figure below shows the basic structure of a bar code.

![Figure 3: Structure of a bar code](image)

The structure consists of the following:

- A leading and trailing quiet zone
- A start pattern
- One or more data characters
- One or two check characters
- A stop pattern

The main purpose of bar coding is to be able to identify an item by labeling the item with a bar code containing a unique character string. A database is typically used in conjunction with bar codes and is used as an index to a record and contains all of the relevant information needed about an item that is being scanned. For example, when a salesman scans a bar code in a mattress store, the data is sent to a computer that obtains all of the relevant detailed information on the specific product. This could include the price, stock availability, detailed description etc. Bar codes make it easy to assign prices and information to a specific product. This can be done by modifying a single
entry in the database. The database also allows the user to track the amount of stock available for all products, which makes it easy to know when to re-order. (Taltech, 2010)

4.2.3.2 Bar code symbologies

Sets of space patterns are grouped together, which in turn forms a symbology. There are a wide variety of different bar code symbologies, each containing their own characteristics, which was originally developed to fulfill a specific industry’s needs. These symbologies have become universal standards and are used throughout most of the industries today. B-Coder (discussed later) supports most of these symbologies. (Wikipedia, 2010)

For my project purposes the most common code, Code 39 (Normal and Full ASCII versions), will be used. In the non-retailing world, Code 39 is considered the most popular symbology and is used specifically in health applications. The code is a variable length symbology that can encode the following characters: 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ- $/%+. Code 39 is considered extremely accurate with only 1 error in every 1.7 - 4.5 million scans. Figure 4 below illustrates what a Code 39 bar code looks like. (Taltech, 2010)

![Figure 4: Code 39 bar code](image)

Appendix A contains a full list of bar code symbologies.

4.2.3.3 Bar code readers

There are currently only 4 readers available on the market. These include:

- Pen type readers
- Laser scanners
- CCD readers
- Camera based readers

Each of the above mentioned readers uses a slightly different technology for reading and decoding a bar code. Laser scanners seem the obvious choice as it uses the most reliable, basic technology, and is thus the least expensive. A specific bar code reader will be chosen later on in the project, regarding the warehouse requirements and price. (Taltech, 2010)
4.2.3.4 **B-Coder Pro**

B-Coder is a professional bar code generator that allows bar codes to be efficiently incorporated into documents and or labels by using Microsoft Word. B-Coder Pro lets you print perfect bar codes from any printer. Figure 5 shows how easy the program works. This software can easily be incorporated into current bar code systems being used. (Taltech, 2010)

![Figure 5: B-Coder Professional Software](image)

4.2.3.5 **BC-Wedge**

BC-Wedge is an easily installed data collection software product that captures all of the necessary detailed information that is stored on the bar code. (Taltech, 2010)
4.2.4 Bar code uses in Forensic Pathology services

Bar codes have been proven reliable and efficient. The main advantage bar coding have over RFID is that it is extremely cheap. With relatively "small" start-up capital required, coupled with extremely inexpensive running costs, bar coding seems a viable alternative to the more advanced RFID technology. Identified uses for bar coding include the following:

- Keeping track of stock in the centralized warehouse (centralized warehouse discussed later)
- Attaching bar codes to police files, evidence and bodies, linking them with a central database

4.3 Why have a centralized Warehouse

In today’s economic climate all possible options to eliminate unnecessary and inefficient inventory management systems, need to be taken into account. A recent lean philosophy trend into warehouse operations is directly designed to attack and eliminate any unnecessary wastes including inventory, bottlenecks, defects, and waiting times. The goal of this philosophy is to ultimately streamline warehouse operations. However, warehouses are extremely vital to companies and therefore can’t be totally eliminated.

In the case of the Gauteng Forensic Pathology services a centralized warehouse seems a viable solution to the current problem (discussed earlier). Although the advantages of a centralized warehouse have to be compared with the disadvantages, it is clear that in this case the advantages far outweigh the disadvantages. Advantages include:

- Less time waiting on the MSD(Medical Supply depot) on stock
- No more time and resource wasting in obtaining quotes from approved suppliers
- Consistent quality products
- Simplified order processing
• Reduced working capital
• Reduced inventory
• Optimized inventory allocation
• Inventory Transparency
• Lower Rent

A big disadvantage still remains: the initial start-up capital necessary. Because of a lack of funds, an existing facility had to be identified. Three Facilities were identified. However, these warehouses do seem to pose a lot of new challenges for ex. space available to store items, out of date equipment etc. However, it is suggested that funds be made available by the Department of Health and Social Development so that a specific warehouse can be built to cater to all the needs of the Gauteng Forensic Pathology services. (Benefits of centralized inventory management, 2009)

4.4 Warehouse Operations

Products that are procured by approved suppliers will be delivered at the warehouse, where it will be repacked and reorganized accordingly. The following processes are followed to reorganize the product within the warehouse:

• Inbound processes
  Receiving
  Put away
• Bulk storage
• Outbound processes
  Order picking
  Checking, packing

Generally, after the products have been received it will be consolidated into a single shipment and sent to the appropriate customer. However, in the case of the Gauteng Forensic Pathology service, the shipment won’t be sent out immediately. Once a month, each morgue will send out a truck to the warehouse to pick up a forecasted 1 months supply of the medical expendable items needed (prescribed by the Department of Health). Further instigation into the space available at Diepkloof will reveal how much stock can be stored at the warehouse. The trucks, from each of the morgues, will have a specific time during the month when it can collect its monthly supply. This is an important schedule that will be worked out in detail to prevent stock from being
unavailable upon collection. The monthly collection poses a new problem: a month’s stock now have to be stored at each morgue. (Bartholdi& Hackman, 2008)

The following figure represents a study by J.Drury, 1988 about the warehouse cost per category.

![Figure 7: Warehouse cost per category(J Drury, 1988)](image)

4.4.1 Product Control

Visibility of assets and items are very important, especially when working with medical expendable items. Upon arrival, the product must be labeled and scanned to indicate that the product is ready to be moved to storage. At storage, the product is scanned to indicate that the product have been placed at the designated location. When picking occurs, the picker is allocated to the correct location of the product. The picker scans the location to ensure he is at the correct location. A label is scanned and printed on each box containing the picked products. This confirms that the pick has been made. By using this scanning process inventory control is managed more effectively. Less paperwork and labour, and increased security are a couple of other benefits.

4.4.2 Receiving

The product arrives at the warehouse in pallet form. Inspections are done to ensure that no product have been damaged or is missing. Once this has been done, a scanned label is printed on the product. This specifies the quantity and type of product. Once the above mentioned processes have been completed, ownership of the received product is
taken, payments are made and the customer availability is noted in the system. (Facilities Planning, 2003)

### 4.4.3 Put away

It is very important to know the correct location of the received product. This will have a considerable effect on the efficiency and costs occurred upon retrieval of the product. That is why it is necessary to know at all times where open bins are, their weight capacity and size. Forklifts are generally used to move the product from the receiving area to the assigned location. Once placed at the correct location, the product is scanned to confirm placement. (Facilities Planning, 2003)

### 4.4.4 Bulk Storage

Bins are specific storage locations that are divided into a warehouse. These bins contain a unique address, which describes the shelf positions and the amount of cubic space occupied. Security, rent and air conditioning adds to bulk storage expenses. It is thus necessary to use the available space as efficiently as possible so as to minimize the costs incurred. (Facilities Planning, 2003)

### 4.4.5 Shared versus dedicated storage

#### 4.4.5.1 Shared Storage

This is a storage method that requires each product to be assigned to various bins (more than one). A product can immediately be reassigned once a location becomes available. Thus space utilization is increased because a product is distributed over a bigger variety of storage bins.

Disadvantages:

- Time consuming put-away process.
- Complicated picking
- Expensive and complicated software needed

Advantages:

- Better utilization of space
- Improved security
4.4.5.2 Dedicated Storage

A specific bin is assigned to each product and only that product may be stored there.

Disadvantages:

- Inefficient space utilization
- Negative security implications

Advantages:

- More efficient picking
- Popular items stored in preferred locations
- Less expensive software needed.

4.4.6 Piece Picking

A list of orders is received by a customer, with the type of product and quantities. These are sent to the picking operations in batches. A picking document containing all the relevant information (location, aisle, quantities) is given to the picker. The picker then starts accumulating the items. Upon completion of the order the tote is forwarded to the packing department.

Piece picking is generally used at warehouses with high outputs. Therefore extensive research needs to be done to be able to implement the system correctly seeing as the warehouse at Diepkloof will not have high outputs. (Inventory Operations, 2010)

4.4.7 Checking and Packing

Packing presents an ideal time to check up on the order because, the packing is very labour intensive and each product is handled individually. Order accuracy is of the utmost importance to any company. Penalties can be incurred on orders not fulfilled correctly. Incorrect orders also increase returns, which in turn add to unnecessary expenses and handling of goods. After check up, the items are stored in either plastic-or carton containers. An invoice is added to the package. The checking and packing department thus plays an important part in the whole process. They add value to the items, but at quite a labour intensive price.
4.4.8 Shipping

For my project shipping won’t be looked at seeing as each morgue sends a truck to collect the items themselves.

4.5 Inventory Management

A key part of any business is inventory management. Although not the core of every business, it plays a major role and is critical to minimize expense and increase profitability. According to Womack et al., 1990 the 3 components of inventory management include:

- organizing inventory supply
- work-in-process inventory
- final product

A shift from maintaining a large inventory to lean production, and in particular JIT inventory management is today being implemented and seen as the norm for almost every business. This is achieved by having smaller, but more frequent ordering quantities. Storage space, however, still need to be brought into consideration for ex. when all of the scheduled deliveries takes place at the same time. Ultimately incoming trucks will load directly onto outgoing trucks, the phenomenon of cross-docking.

4.5.1 Models

Consider the exponential smoothing model as discussed in Ferbar, Čreslovnik, Mojkerc, Raijgelj, 2009. This model is generally used for demand forecasting where there are no large fluctuations in demand. This is considered an appropriate model considering that the morgues demand will more or less stay constant throughout each season. However, if for some reason the data given to me is not sufficient (long time period), another model should be used. A simple moving average model is therefore included.

4.5.1.1 Exponential smoothing model

A simple model: \( \hat{D}_{t+1} = D_t \), where \( \hat{D}_{t+1} \) is the predicted demand for the next time period and \( D_t \) is the demand at time t. This is considered a conservative decision rule where it is predicted that the future demand will not differ from the current demand. As can be predicted it is not ideal when there are any substantial changes in demand. The smoothing model is a generalization of the simple model. This model “smoothes” out the bumps caused by predicted and actual demand as:

\[ \hat{D}_{t+1} = \bar{D}_t + \beta (D_t - \bar{D}_t) \]
\( \beta \) is a decision rule coefficient with a value between 0 and 1. \( \beta \) acts as a damping mechanism for fluctuations of external demand. The value of \( \beta \) is differently addressed for each case. Values of \( \beta \) close to one have less of a smoothing effect whereas values of \( \beta \) closer to 0 have a greater smoothing effect. This causes that the larger \( \beta \) values gives greater weight to recent changes.

4.5.1.2 Simple Moving Average

The simplest way to smooth data is to calculate the moving average over a time period.

\[
S_t = \frac{1}{k} \sum_{i=0}^{k-1} x_{t-i}
\]

The smoothed statistic \( S_t \) is the mean of the last \( k \) observations. A small \( k \) value will have less of a smoothing effect, whereas a large \( k \) value will have a greater smoothing effect.

![Diagram](image-url)
4.6 Business Intelligence

Business intelligence (BI) is included in my project to help the central warehouse manager cope with the vast amount of data. BI is seen as an emerging management function. The term, Business Intelligence, refers to technology, applications, analysis, knowledge, and practices which allow companies to make more highly informed decisions that will place the company on the path of success. Business Intelligence is thus also known as a “decision support system” and a data mining tool. For the purposes of my project, the use of BI software within the central warehouse, will be illustrated. (Conradie, 2004)

4.6.1 Introduction to Business Intelligence

The operational performance and functional direction of the central warehouse needs to align to its strategic goals. This calls for efficient, accurate measurements to analyze performance on strategic and tactical levels. Unfortunately, the warehouse manager struggles to define performance metrics and translate the large amounts of data collected on a daily basis into usable and actionable information.

Business Intelligence, through the use of software applications, provides a way of expanding the types of raw data and information collected on business operations and then narrow the focus on the necessary information required to direct management on decision making. These applications serve as data warehouses for analyzing, cleaning, interpreting and translating data. (Consultants, 2004)

With regards to Gartner’s Framework, as can be seen in Figure 9, applying BI within the Gauteng Forensic Pathology services will bridge the gap between business and information technology. One should therefore improve the quality of information content since it has impact on the accomplishment of strategic business objectives through improved decision-making. (Hostman, B, 2006)
4.6.2 Critical Success Factors

For the effective and successful implementation of a BI system within the Gauteng Forensic Pathology Service, the following critical success factors have been identified (William Yeoh, 2009):

- **Committed management support and sponsorship.** In order to overcome challenges such as information flow, people issues and cross-functional framework development commitment from top management is required for BI initiatives.

- **Clear vision and well-established business case.** The BI initiative should be clearly described and aligned with organizational goals with the use of a business case. To be able to address problems regarding decision-support, business processes and needs should also be established and confirmed in the business case.
• **Business-centric championship and balanced team composition.** This factor involves that the BI system is not viewed in technical terms, but strategic and organizational terms. This team consists of technically knowledgeable members who are committed to the BI team leader, IT and business representatives and members who have business insight. BI coordination, support and deployments are easily controlled and driven over multiple organizational departments.

• **Business-driven and iterative development approach.** The two areas that can lead to buy-in and scheduled programs that deliver quick wins, include first the adoption of an iterative approach. The second area is the provision of a clearly defined scope of the BI system implementation at the outset.

• **User-oriented change management.** Throughout the implementation of the BI system, the key users and functional managers play a role. This involves their participation during the maintenance process for further development of improvements. In order to provide training, support and education to encourage individuals to adapt to new practices and technologies, a BI competency team is set in place.

• **Business-driven, scalable and flexible technical framework.** This framework includes the alignment of short and long-term business requirements, including internal and external data sources, with data modeling and architecture design.

• **Sustainable data quality and integrity.** This includes a data governance framework that will ensure that the collection of data is well monitored. A foundation of high-quality data at source systems and ascertain definitions, measures and classifications that are well-known across the organization, are also in place.

### 4.6.3 Key Performance Indicators

A performance indicator or Key Performance Indicator (KPI) is a measure of performance of an organization. Such measures are commonly used to help an organization define and evaluate how successful the organization is, usually in terms of the organization’s progress towards its long-term organizational goals. KPIs are measures by which the performances of organizations, business units, and their division, departments and employees are periodically assessed. They differ from business to business depending on the nature of the business and the business' strategy. Performance Indicators also differ from objectives or goals of a business or an
organization. The defined norms have to be achievable, the KPIs have to be relevant to measure and it must be time phased, meaning the value or outcomes must be shown for a predefined and relevant period.

Unfortunately there are no specific KPIs for Business Intelligence since BI is a tool for Data Mining. KPIs can be monitored using Business Intelligence techniques and tools to assess the present state of the business and to assist in identifying the course of action. For example a business can consider the percentage of income from return customers or the percentage of customer satisfaction as a potential KPI depending on what the business wants to measure.

4.6.4 Business Model

The process used for illustrating the execution of BI, was adapted from CRISP-DM 1.0. A functional model and process model is discussed. Due to the fact that BI includes multiple data sources and various disciplines for executing BI, a specific data model cannot be defined. (Chapman et al., 1999)

4.6.4.1 Process Model

The process model illustrating the execution of BI can be seen in Figures 10 and 11. This model was designed using syntax reference provided by IDEF3. (Mayer et al., 1995)

Figure 10: Process Model for executing BI - First level process
Figure 11: Process Model for executing BI - Second to sixth level processes
4.6.4.2 Functional Model

The functional model for executing BI in an organization can be seen in Figure 12. This model was designed using syntax reference provided by IDEF0 (IDEF0, 1993). The table below describes the inputs, outputs, constraints and resources of each process phase as illustrated in Figure 12.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Data</td>
</tr>
<tr>
<td>C1</td>
<td>Data availability</td>
</tr>
<tr>
<td>C2</td>
<td>Time, Complexity and insufficient skills</td>
</tr>
<tr>
<td>C3</td>
<td>Time, skills, tool availability and technical difficulties</td>
</tr>
<tr>
<td>C4</td>
<td>Time, skills and technical difficulties</td>
</tr>
<tr>
<td>C5</td>
<td>Skill</td>
</tr>
<tr>
<td>C6</td>
<td>Technical difficulties, time and Complexity of system</td>
</tr>
<tr>
<td>O1</td>
<td>Preliminary plan to achieve objectives</td>
</tr>
<tr>
<td></td>
<td>Clear understandable data</td>
</tr>
<tr>
<td>O2</td>
<td>Familiarised data</td>
</tr>
<tr>
<td></td>
<td>Hypotheses for hidden info</td>
</tr>
<tr>
<td></td>
<td>Identified and incomplete raw data</td>
</tr>
<tr>
<td>O3</td>
<td>Final dataset</td>
</tr>
<tr>
<td>O4</td>
<td>Models</td>
</tr>
<tr>
<td></td>
<td>Technical requirements</td>
</tr>
<tr>
<td>O5</td>
<td>Evaluated model that achieved and not achieved the objectives</td>
</tr>
<tr>
<td></td>
<td>Decision on the use of data mining results</td>
</tr>
<tr>
<td>O6</td>
<td>Reports</td>
</tr>
<tr>
<td></td>
<td>Scoring</td>
</tr>
<tr>
<td></td>
<td>Repeatable mining process</td>
</tr>
</tbody>
</table>

Table 1: Inputs, Outputs and Constraints for BI function model
Figure 12: The Functional Model for executing BI
5 Chapter 2: Data and Information Gathering

The data and information gathering phase started with the collection and documentation of the factors that needed to be included in selecting the correct warehouse. When the warehouse was selected and implemented, the warehouse operations were looked at and analyzed. In order for improvements to be made to the current warehouse the following information is required:

- Procurement and requisition process
- Current Layout
- Order Picking
- Receiving and shipping operations
- Available Space

There are no current technological applications (RFID or Bar coding), and no form of forecasting methods are used to determine the item quantities etc. Therefore there were no data that could be gathered except for the relevant item data (items procured and requested). This part of my project had to be developed and is included in chapter 3 (Solution Design and Implementation).

5.1 Legislation and Regulations

The Department of Health and Social development have to comply with certain health and safety regulations as well as regulations concerning the overall process of operations. It is of extreme importance that these regulations are followed as it can hinder a whole operation if not followed properly. The regulations and legislations include the following:

- Public Finance Management Act (PFMA)
- National Treasury Regulations
- Preferential Procurement Policy Framework Regulations
- Broad Based Black Economic Empowerment Act (Act 53/2003)
- Policy Strategy to Guide Uniformity in Procurement Reform
- Processes in Government approved by Cabinet on 2003-09-10
• Anticorruption measures and practices
• Labour Relations Act
• Basic Conditions of Employment Act
• Code of Conduct for Public Services
• Gauteng Provincial Government Supply Chain Management Manual

5.2 Central Warehouse Selection Factors

Data and information regarding the implementation of the proposed warehouse needed to be justified. Thus extensive research regarding problems with the current system was done in order to justify the proposed centralized warehouse. When designing a warehouse it is important to realize that a warehouse is not just a storage area, but an integral part of a system. The following aspects needed to be considered:

• Identifying a site for the central warehouse
• Space requirements
• Recruitment and selection of staff
• Standardized store items
• Legislation regulating stores
• Job descriptions
• Consultation with officials
• Challenges
• Funding
• Reporting Structures

5.2.1 Problem areas identified

Site visits were made to identify the problems that the facilities were dealing with. The main problem concerning these facilities is that there are no qualified warehouse/store personnel in charge of operations. Thus the medical practitioners have to handle the operations as well as their official job of doing post mortems. Problems identified at these sites include:

• Old SAP items (forms, registers) not in use are not disposed of and take up space
• No training given to staff responsible for stores at the facilities
• VA cards are not implemented, completed and updated
• Minimum and maximum stock levels are not adhered to
• Non disposal of items that have expired or are not in use for more than a year
• Stocking of non essential items
• Sore items are not stored separately (chemicals, stationary and medical are put together in a store) due to a lack of store space
• Bin cards are not kept with stock items on the shelves
• No extractor fans in chemical or other stores
• No smoke detectors
• No sprinkler systems in case of fire
• No security (CCTV or other devices)
• No proper job descriptions for officials doing stores

5.2.2 Challenges

Before the centralized warehouse can become operational, certain challenges needs to be addressed. These include:

• Site identification
• Consultation with the facility manager of the identified site and his role to the central warehouse
• Personnel recruitment
• Funding
• Stock that will be accepted by all end users (mortuaries)
• Time frame for roll out of stores
• Training of staff
• Current stock in facility stores
• Opposition against a Centralized warehouse

5.2.3 Warehouse requirements

The basic warehouse requirements that will be needed for the central warehouse were identified as the following:

• Office furniture (Universal workstations, chairs, filing cabinets, lockers, reception counter, visitors chairs, shredding machine, magnetic white boards, pinboards, letter trays, dustbins)
• Stationary (Registers, VA Cards and Forms, Other official documentation that may be required)
• Protective Clothing (Dust Coats, Safety Boots, Masks)
• Shelving for small box items
• Palades for large bulk items
• First Aid Box to comply with OHS standards
• Computer Equipment for electronic systems (BAS, MEDSAS, SAP, BAUD, MEDICON)
- Fire fighting and detection equipment (smoke detectors, sprinkler systems, fire extinguishers)
- Security Systems (CCTV cameras, access control systems)
- Communication Systems

### 5.2.4 Recruitment and selection of store personnel

Informal interviews were held with the personnel currently handling the stores at the different facilities at the morgues. General consensuses were that most of them will be available or want to work at the central warehouse. During visits to established stores within the Department of Health (Hospital stores and Medical Supplies Depot) a staff establishment for the central warehouse could be recommended.

<table>
<thead>
<tr>
<th>Position</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor</td>
<td>10</td>
<td>Manage the central warehouse</td>
</tr>
<tr>
<td>Accountant</td>
<td>7</td>
<td>Manage financials</td>
</tr>
<tr>
<td>Driver</td>
<td>5</td>
<td>Self explanatory</td>
</tr>
<tr>
<td>Senior Admin Clerks</td>
<td>4</td>
<td>Admin responsibilities</td>
</tr>
<tr>
<td>Security Guards</td>
<td>3</td>
<td>Secure safe environment</td>
</tr>
<tr>
<td>Cleaners</td>
<td>3</td>
<td>Clean the store</td>
</tr>
<tr>
<td>General Assistant</td>
<td>3</td>
<td>Assist the supervisor with general management</td>
</tr>
</tbody>
</table>

**Table 2: Personnel required**

In order to save costs, it is recommended that the staff recruitment and selection be done within the FPS staff.

### 5.2.5 Identified sites

The sites identified as a viable central warehouse were, Diepkloof, Pretoria and Springs. In order to choose the correct facility from the above mentioned three, several factors (infrastructure, impact on the facility, storage space, layout and the centrality) had to be considered and reviewed. Seeing as the impact on all 3 facilities would be the same and the infrastructures were all adequate, it was concluded that the most important factors were:

- Centrality
- Storage Space
Current Layout

5.2.5.1 Centrality

<table>
<thead>
<tr>
<th>Distance to other sites</th>
<th>Identified Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Springs</td>
</tr>
<tr>
<td>Springs</td>
<td>-</td>
</tr>
<tr>
<td>Diepkloof</td>
<td>54</td>
</tr>
<tr>
<td>Pretoria</td>
<td>73</td>
</tr>
<tr>
<td>Bronkhorstspruit</td>
<td>102</td>
</tr>
<tr>
<td>Ga-Rankuwa</td>
<td>102</td>
</tr>
<tr>
<td>Germiston</td>
<td>33</td>
</tr>
<tr>
<td>Heidelberg</td>
<td>36</td>
</tr>
<tr>
<td>Sebokeng</td>
<td>92</td>
</tr>
<tr>
<td>Fochville</td>
<td>112</td>
</tr>
<tr>
<td>Roodepoort</td>
<td>63</td>
</tr>
<tr>
<td>Johannesburg</td>
<td>45</td>
</tr>
<tr>
<td><strong>Total kilometers</strong></td>
<td><strong>712</strong></td>
</tr>
</tbody>
</table>

Table 3: The distance to other sites from identified sites

As can be seen the Diepkloof facility is the most central to the other morgues. In terms of centrality, Diepkloof was identified as the central warehouse. This is due to the fact that 7 out of the 11 facilities are located within the Southern Cluster of Gauteng (Johannesburg area).

5.2.5.2 Storage Space

The spaces available for storage have all been measured and are shown in table 4. All values are in square meters.
<table>
<thead>
<tr>
<th>Area</th>
<th>Diepkloof</th>
<th>Springs</th>
<th>Pretoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatch receiving returns</td>
<td>26.56</td>
<td>24.67</td>
<td>35.76</td>
</tr>
<tr>
<td>Stationary</td>
<td>23.55</td>
<td>12.23</td>
<td>31.6</td>
</tr>
<tr>
<td>Medical</td>
<td>59.56</td>
<td>45.7</td>
<td>53.29</td>
</tr>
<tr>
<td>Chemical</td>
<td>12.56</td>
<td>11.34</td>
<td>8.45</td>
</tr>
</tbody>
</table>

**Table 4: Storage space availability**

As the table indicates it can be seen that Pretoria has slightly more overall space available compared to Diepkloof. As mentioned in the literature review, these spaces are currently used to store each individual facility’s items. It is these storage spaces that will have to be adapted and combined in order for the central warehouse to have an adequate amount of space. Diepkloof have the most space and is therefore the preferred choice in terms of space available.

### 5.2.5.3 Current Layout of sites

The design of a facility is of extreme importance as it affects the facility’s ability to correctly carry out its purpose. A current layout of the whole facility, including the warehouse is shown in Appendix C. These layouts show the relationship between all the buildings on the site and provide a general idea as to what the facilities actually look like. The layouts indicate the storage space that is looked at, at each facility, consists of either 3 or 4 small storage spaces that is currently used as warehouses to keep each individual facility’s relevant items and medical expendable items. As previously explained each facility throughout Gauteng procures their own stock. These small warehouses, when the central warehouse is implemented, will be used to store the items procured from the central warehouse.

As can be seen on the different layouts all of the stores are of a rectangular shape and all is situated directly next to each other. This makes it rather easy as the similarity in shape doesn’t really have an impact on the selection of the central warehouse. However, when looking at the Diepkloof layout, the store is situated more towards the
back of the facility near the morgue area. Only certified personnel can enter this area, meaning that the public is forbidden. This is in contrast with the Springs and Pretoria facility where the stores are situated right in front of the public parking and the administration and office building. This makes the Diepkloof facility the preferred layout when looking at the facility as a whole.

5.2.5.4 Conclusion
When taking the above mentioned factors (centrality, storage space, and layout) into account it is quite clear that the Diepkloof facility is the facility that will be used as the central warehouse.

5.2.6 Organogram (Central warehouse Structure)

![Organogram of the central warehouse](image)

Figure 13: Organogram of the central warehouse

5.2.7 Job descriptions
As can be seen in the above figure, the vacant posts is shown (blue border). These are the posts that had to be filled once the central warehouse got up and running. Research into these vacant jobs needed to be done in order to establish the key performance areas, job outputs, job standards, and the job indicators. A small description of the purpose of the job of the various posts is given below. The complete tables can be seen in Appendix A.

- Central warehouse Manager – To ensure effective and efficient management of the central warehouse and service delivery
- State Accountant – To implement, promote and maintain cost effective and efficient internal control mechanisms for accountability of public funds in support of quality Forensic Pathology Service
- Warehouse Clerk – To implement, promote and maintain cost effective and efficient internal control mechanisms for accountability of public funds in support of quality Forensic Pathology Service
- General Assistant – To support the warehouse clerk in his/her operations
- Accounting Clerk – To ensure accurate financial statements regarding the central warehouse

![Image of the central warehouse]

**Figure 14: The central warehouse**

### 5.3 Current Situation at the Central Warehouse

During July the Central warehouse in Diepkloof was implemented. However, as previously mentioned, budgetary constraints limited the central warehouse to be chosen between existing facilities. At the moment the store in Diepkloof can’t handle the current amount of items needed by the various morgues throughout Gauteng. Thus only specific items can be procured through the central warehouse by the various morgues.
It is clear that this is not ideal as the morgues still have to procure some items using the 3 Quote system (mentioned in the literature study). However this is still more efficient for the morgues seeing that they now don’t have to fill in any paperwork. This paperwork included auditing and internal risk management. A full list of the items procured through the central warehouse can be viewed in Appendix C.

5.3.1 Procurement and requisition process

The central warehouse is currently run by only 1 person. The current rule of thumb is to randomly order stock as the stock is collected by the various morgues. As the stock gets delivered to the warehouse, it is counted (manually) and randomly placed within the warehouse. Morgues collect items by driving to the warehouse (most of the time without even calling to make sure whether the correct amount of stock is available). Upon arrival they request a certain amount of items. They then receive the items, loads it into the truck and return to their respective morgue. It is quite obvious that the system, or lack thereof, is extremely inefficient.

5.3.2 Layout

The correct design of a facility is of the utmost importance, seeing as it affects the efficiency and productivity of the warehouse. A current layout is included to see how the warehouse operations are performed as well as to indicate the parts within the warehouse that are not used effectively. The current warehouse layout is shown in the figure below.

![Figure 15: The current layout of the central warehouse](image-url)
5.3.3 Order Picking

It is apparent that order picking operations don’t exist. When morgues collect items, the current principle is to remove the closest available box from the shelf and place it in the truck. The employee responsible for the warehouse fills in a Tally card as well as a Bin card. This is done to keep track of the available stock and the amount issued.

![Figure 16: The current storage layout](image)

5.3.4 Receiving and Shipping operations

The shipping and receiving area are at the same location that creates an ergonomically unfriendly environment which influences the movement. Although the available space is enough to receive or to ship, it isn’t large enough for both. Figure 17 on the next page shows the receiving/shipping area.
A layout must be developed while considering available space and other space requirements needed for the storage of materials. The popularity of items, as well as similarity and size also need to be brought into consideration. With an approximate area of 123m², the warehouse at Diepkloof is considered very small. The warehouse consists of 2 shelves of size 7mX1.9mX0.4m, as well as 6 smaller shelves of size 5mX1.9mX0.4m.

Although there is no space available for forklifts, it isn’t considered a problem. This is because the weight of the boxes stored in the warehouse is considered light and is easily carry able by a person.
6 Chapter 3: Solution Design and Evaluation

6.1 Warehouse operations and layout

The system considered most necessary to any warehouse is the physical system. This system ensures that any outdated, constraining or misapplied activities are rectified, which eventually ensures effective and efficient warehouse operations.

The design of the layout is considered extremely vital as it plays a role in future cost reduction. A faulty design can lead to extra costs including cost of space and cost of material handling. At first these costs will seem relatively small when looked at individually, but given time, these costs can add up to a substantial amount. These extra costs are considered extremely unnecessary and unwanted. Before the design of a layout can commence there are specific objectives, key considerations and performance outputs that need to be considered. In general they include the following:

- Efficient use of space
- FEFO (First Expiry date First Out)
- Most efficient material handling
- Minimum aisle space
- Most efficient use of equipment
- To make optimal use of available labour
- Logical flow of goods
- To allow the warehouse to provide maximum flexibility in terms of changing requirements
- Minimum travel distance

As mentioned earlier in Chapter 2, the layout of the existing facility will be improved by studying the procurement and requisition process, the current layout, order picking, receiving/shipping operations, and the space available.

Although it is considered extremely difficult to determine the correct space requirements, it is not necessary for the purposes of my project. The warehouse is a fixed building on the Diepkloof Morgue Facility, and with no current plans to change or build a new facility, it is going to stay exactly the way it is. Thus, what needs to be determined is how the space can be used as effectively as possible. The most important consideration is to arrange/rearrange the storage shelves and the aisle space needed by the personnel.
Receiving and shipping operations, shown in figure 17, happen within the same area. This is a major problem as it not only hampers the time, but efficiency as well. There are currently three roll-up doors that can be used. However, figure 18 shows that two of these doors are obstructed due to items stored on the floor in front of the doors. One of these doors could be used as either a shipping or receiving area. Considering the space available in front of the store, accessing the warehouse (personnel and trucks) is not an issue.

**Figure 18: Current layout with obstructed doors**

It is important to view the shipping and receiving as two different operations and therefore needs to be separated into two different areas in order to maintain control of the different functions.

Below are different arrangements that can be used for the shipping and receiving areas.

**Figure 19: Possible shipping/receiving arrangements**
The most critical function of the distribution operations is the order picking. According to warehouse professionals this is considered the highest priority activity which has a direct effect on productivity. As discussed in Chapter 2, it is clear that there is no current order picking process or basis to work on. The warehouse is relatively quiet (in terms of material flow) and small which makes it quite easy to correct the lack of an order picking process. The shelves will be numbered alphabetically to ensure that the different shelves are easily distinguishable. This will help the personnel to store the different items on the correct shelf. The items that are used the most will be placed closest to the shipping area so that upon collection the items can be retrieved easily and efficiently.

Because medical items are stored it is important to implement the FEFO (First Expiry date First Out) process. This can be implemented by instructing the personnel to ship the closest box on the appropriate shelf, and to store a received box at the furthest point of the shelf. By doing this, the older (although not expired) items will always be shipped out.

The following pages contain alternative warehouse designs with the red and blue shelves representing different lengths. The shelves all have a width of 40 cm.

![Alternative warehouse design A](image_url)
Figure 21: Alternative warehouse design B

Figure 22: Alternative warehouse design C
By using the weighted factor comparison method, the alternative solutions can be weighed up against a common set of factors in order to determine the best solution. The factors are:

- Available storage space, the space that is available to store the items in the warehouse
- Process operations, all operations required
- Flexibility, ability to adapt and rearrange the warehouse

The available storage space was listed as the highest priority as this is the main problem with the current warehouse. With more space available, more and different items can be stored. The different morgues will benefit significantly because more items can be ordered directly from the warehouse. Process operations are listed as the second highest priority. This is considered important because efficient operations can lead to an overall productivity improvement within the warehouse and effectively within the department. The warehouse flexibility is included to cater for possible future changes within the warehouse.

By determining the area of the shelves, the available space could be identified. It was not necessary to determine the volume as the height of the shelves is constant for all of the designs. The different shelves’ height restrictions are not a problem as the boxes all...
have a standard size. Thus, the height of the shelves currently used is seen as the ideal height. The table below shows the calculations done to determine the area available.

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout A</td>
<td>20.92m²</td>
</tr>
<tr>
<td>Layout B</td>
<td>18.04m²</td>
</tr>
<tr>
<td>Layout C</td>
<td>17.4m²</td>
</tr>
<tr>
<td>Layout D</td>
<td>19.36m²</td>
</tr>
</tbody>
</table>

Table 5: Calculations – Area available

The above areas, as well as the process operations and the flexibility were converted to a rating out of 10. Table 6 shows the results of the weighted factor comparison.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weight</th>
<th>Layout A Rate</th>
<th>Layout A Score</th>
<th>Layout B Rate</th>
<th>Layout B Score</th>
<th>Layout C Rate</th>
<th>Layout C Score</th>
<th>Layout D Rate</th>
<th>Layout D Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Storage Space</td>
<td>10</td>
<td>10</td>
<td>100</td>
<td>8</td>
<td>80</td>
<td>7</td>
<td>70</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>2. Process Operations</td>
<td>7</td>
<td>8</td>
<td>56</td>
<td>8</td>
<td>56</td>
<td>7</td>
<td>49</td>
<td>9</td>
<td>63</td>
</tr>
<tr>
<td>3. Flexibility</td>
<td>3</td>
<td>8</td>
<td>24</td>
<td>6</td>
<td>18</td>
<td>7</td>
<td>21</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>180</strong></td>
<td></td>
<td><strong>154</strong></td>
<td></td>
<td><strong>140</strong></td>
<td></td>
<td><strong>177</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Weighted factor comparison

Layout A scored the highest in the weighted factor comparison and is therefore the proposed layout. It has the most storage space, enough flexibility for possible future expansions as well as the ability to handle process operations effectively. The cost involved is minimal with the shelving cost being the only expense.
6.2 Bar code system

As mentioned earlier in the literature review, bar code technology had to be weighed against RFID technology in order to determine which would suit the Gauteng Forensic Pathology services the best. There were a couple of factors that needed to be considered before a choice could be made. Three main factors were identified:

- Cost, including running cost and start-up capital necessary
- Easiest system to implement
- Gauteng Forensic Pathology services needs

A more advanced system is generally accepted as the preferred choice, in which case the RFID system is the clear choice. However, when weighing up the needs against the cost, the bar coding system is the clear choice. This is why it was decided that bar coding will be used instead of the much more expensive RFID system. Bar coding also uses scanners that are easier to use, as well as user friendly computer software. This will make the implementation and overall use of the system much easier. The following pages describe how bar coding systems can be used within the Gauteng Forensic Pathology services.

6.2.1 Warehouse Operations

The use of bar coding software will have a dramatic impact on the current warehouse operations. Not only will it remove the manual labour (counting stock & paperwork), it
will also improve the accuracy of stock on hand. Research was done to determine what bar coding system will suit the warehouse requirements the best. Cradle Technology Services was identified as the company with the correct system called Facets.

Facets are an asset identification, management and scanning system that are extremely simple to use. Some of the features include the following:

- Integration with PASTEL or ACCPAC is available
- Detailed reporting by category, location, stock on hand etc.
- Exports the data to Excel
- Customization of asset fields including:
  - Make, model and serial number
  - Cost, condition and status

### 6.2.1.1 Cost of system

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software</strong></td>
<td></td>
</tr>
<tr>
<td>1 X FACETS Software package (Single PC Installation)</td>
<td>R 15,000.00</td>
</tr>
<tr>
<td>1 X PORTABLE Scanner Software (Price per scanner)</td>
<td>R 3,800.00</td>
</tr>
<tr>
<td><strong>Hardware</strong></td>
<td></td>
</tr>
<tr>
<td>LXE MX8 Scanner with Charging dock and USB cable</td>
<td>R 11,700.00</td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td></td>
</tr>
<tr>
<td>5 X Installation and Training Services (R 500/hour)</td>
<td>R 2,500.00</td>
</tr>
<tr>
<td><strong>License &amp; Support</strong></td>
<td></td>
</tr>
<tr>
<td>Annual License and support fee (per company per annum)</td>
<td>R 2,700.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>R 35,700.00</td>
</tr>
</tbody>
</table>

**Asset Labels**

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Asset Labels (38mm x 14mm)</td>
<td>R 4.00</td>
</tr>
<tr>
<td>Plastic POLYESTER Asset Labels (Price per label)</td>
<td>R1.50</td>
</tr>
</tbody>
</table>

Table 7: Cost of the Facets system
As can be seen in table 7, the total cost to implement the system is R35700. This is considered inexpensive when considering the advantages. The warehouse suppliers will supply bar codes printed on the box (with relevant data of item), which means that the warehouse manager won’t have to buy asset labels to label the received boxes. Although, if a supplier can’t supply items with bar codes, the program mentioned in the literature review, B-Coder Pro, can be used to easily print bar codes. Bar codes can also be bought at the prices mentioned in the table above.

6.2.1.2 Export to Excel
The fact that the entire relevant item data can be exported to excel makes the bar coding system so much more valuable. This will help with the forecasting as well as the incorporation with Sisense Prism. Both uses excel spreadsheets. This part of my project is discussed later in the chapter.

6.2.1.3 Receiving & shipping of items
The following pages include flow charts showing the receiving and shipping processes
Figure 25: Flowchart of warehouse operations - Receiving

Figure 26: Flowchart of warehouse operations - Shipping
6.2.2 Data filing System

After extensive research and interviews with staff and medical officers at the Diepkloof morgue it became apparent that a system linking all of the Gauteng Forensic Pathology services’ data is necessary. Such a system is currently being developed. This part of the project focuses on how bar codes can be used within such a system. Originally bar codes were considered for tagging of bodies and evidence. This idea was later scrapped. However a bar coding system could be used by bar coding a case file and combining it with a central database (previously mentioned). This will make it easier for the medical officers as well as the police to exchange information concerning a specific case, which could lead to quicker and more efficient case solving. The figure below illustrates the proposed process that needs to be followed by the police as well as the forensic officers.

![Flowchart of proposed process](image)

**Figure 27: Flowchart of proposed process**

The process shows how bar coding can be used to assist the police and the Gauteng Forensic Pathology Services. Because the case files are all linked with bar codes, a simple scan will enable the user to view all of the data and findings concerning a specific case.
6.3 Business Intelligence

As discussed in the literature review, Business intelligence will be used to help the warehouse manager understand the data generated from the excel spreadsheets and the bar coding software system. This is done by using Business Intelligence software: Sisense Prism. Not only will it enable the manager to see exactly what the status of the warehouse is (in terms of procurement of items), it will help understand the current performance of the system. Sisense Prism is used as a tool to present the data to management so that valuable decisions concerning the central warehouse can be made.

The following pages include parts of the program developed for the central warehouse. The user has the option to view each month’s data for a specific item. The statistics of Sebokeng and Roodepoort is included to show how the program can help the user in understanding the current situation and the forecasting performance of each morgue. The monthly forecast is considered the amount ordered by the warehouse manager. For program screenshots refer to Appendix E.
Monthly Forecast: Medical Supplies

Morgue: Medical Supplies monthly: Bronkhorstspruit
Item: Plastic Jars

Figure 28: Sisense Prism used to indicate the monthly forecast for the medical supplies
Figure 29: Sisense Prism used to indicate the monthly forecast for other consumables
Monthly Forecast: Stationary & Printing

Morgue: Stationary & Printing monthly: Fochville

Item: A4 photocopy paper box(reams)

![Bar chart showing A4 photocopy paper box(reams) usage](chart1.png)

<table>
<thead>
<tr>
<th>Item</th>
<th>Stationary &amp; Printing monthly: Fochville</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4 photocopy paper box(reams)</td>
<td>13</td>
</tr>
</tbody>
</table>

Top 3

![Pie chart showing top 3 items](chart2.png)

Figure 30: Sisense Prism used to indicate the monthly forecast for stationary & printing
Figure 31: Sisense Prism used to indicate the statistics of Sebokeng
Roodepoort

Date: 30,30 September 2010

Item: Refuse bags black

Figure 32: Sisense Prism used to indicate the statistics of Roodepoort
6.3.1 Forecasting

The forecasting of the items was done by calculating the simple moving average. The more accurate exponential smoothing method could not be used because the only data available to me were the yearly usage of items (31 March 2009-1 April 2010) from the different morgues. Considering the lack of accurate monthly data, the only reasonable forecast that could be made was to divide the yearly quantities by the amount of months. As the months pass the simple moving average will become more accurate seeing as the dividable value becomes larger. With the bar coding system’s ability to collect data over periods of time, as well as manual input from the manager, the forecasting will become more accurate with a shift towards the exponential smoothing method. Appendix D contains a complete item list.
7 Conclusion

The current state of the Gauteng Forensic Pathology service is that of an unimaginative nature. The projects main aim was to investigate and study, and eventually recommend ideas, so that the current processes followed within the Gauteng Forensic Pathology services can be “streamlined”. This was done by focusing on the following three areas:

- Development of a central warehouse management system
- Business Intelligence, coupled with forecasting and software
- Technological applications

The procurement of medical expendable items was done by the three quote system. This made it difficult and time consuming for each morgue to procure the correct items. Thus, the central warehouse was created by using an existing storage facility at the Diepkloof morgue. Although this solved a lot of problems, new problems surfaced and needed to be addressed. These problems were identified and studied in order to be able to make viable suggestions that could be implemented. A new layout was designed by looking at various factors. The overall warehouse management was also looked at and it was found that a bar coding system would help the warehouse manager to manage and control the warehouse more efficiently and correctly.

The bar coding system mentioned above will allow the warehouse manager to export the data captured to excel spreadsheets. These excel spreadsheets is used, together with Business Intelligence and forecasting methods, to create a program so that the warehouse manager can effectively know what the current situation of the warehouse is at all times. This same program can also be used to present the warehouse data and performance to management in such a way that it is understandable. This is important, so that when important decisions regarding the central warehouse were to be made, the right decisions will be made.

Bar coding can also be used to effectively bridge the “information” gap between the police and the Forensic department by linking them with a central database. This will dramatically improve the efficiency and accuracy of future investigations.
8 Appendix A: Bar code Symbologies

Code 39

UPC-A with Supplemental UPC-E

EAN-8 EAN-13 with supplemental (ISBN Version)

RSS-14

CODABAR

INTERLEAVED 2 OF 5

DISCRETE 2 OF 5

CODE 93

CODE 128

EAN/UCC 128

POSTNET

BPO 4 State Code (British Post Office)
# Appendix B: Job descriptions

## 9.1 Central warehouse Manager

<table>
<thead>
<tr>
<th>Key Performance Areas</th>
<th>Job Outputs</th>
<th>Job Standards</th>
<th>Job Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement the business plan with the strategic objectives</td>
<td>-Implementation of the business plan. -Align individual performance to the strategic objectives of the unit. -Develop operational standards -Compile monthly, quarterly and annual reports</td>
<td>-Policy development -General &amp; Strategic advice -Management and support -Departmental code of conduct -Planning and organizing skills</td>
<td>-Business and strategic plans -Develop policies and operational plan -Conduct performance appraisal of employees -Monthly, quarterly and annual reports</td>
</tr>
<tr>
<td>Implementation of</td>
<td>-Create and</td>
<td>-PPPF Regulations</td>
<td>-Policies, norms,</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Policy regulations, practices, directives and procedures</th>
<th>Implement monitoring mechanism strategies that will facilitate the implementation of policies</th>
<th>National Treasury regulations</th>
<th>National Treasury regulations</th>
<th>National Treasury regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-Evaluate the application of National/Provincial policies</td>
<td>-Framework for supply chain management</td>
<td>-Framework for supply chain management</td>
<td>-Framework for supply chain management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>standards, processes and procedures developed and implemented</td>
<td>standards, processes and procedures developed and implemented</td>
<td>standards, processes and procedures developed and implemented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Legislation Compliance</td>
<td>-Legislation Compliance</td>
<td>-Legislation Compliance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Intervention measures available</td>
<td>-Intervention measures available</td>
<td>-Intervention measures available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Procurement policies and guidelines</td>
<td>-Procurement policies and guidelines</td>
<td>-Procurement policies and guidelines</td>
</tr>
<tr>
<td>Management of resources (Financial, assets and human)</td>
<td>-Proper utilization of budget</td>
<td>PFMA (Act 1 of 1999)</td>
<td>PFMA (Act 1 of 1999)</td>
<td>PFMA (Act 1 of 1999)</td>
</tr>
<tr>
<td></td>
<td>-Monitor the implementation of the budget through projects and reporting expenditure</td>
<td>PPPFA (Act 5 of 2000)</td>
<td>PPPFA (Act 5 of 2000)</td>
<td>PPPFA (Act 5 of 2000)</td>
</tr>
<tr>
<td></td>
<td>-Evaluate and ensure performance and appraisal of employees</td>
<td>BAS</td>
<td>BAS</td>
<td>BAS</td>
</tr>
<tr>
<td></td>
<td>-Effective and efficient management of the central warehouses</td>
<td>SAP</td>
<td>SAP</td>
<td>SAP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Labour Relations Act</td>
<td>Labour Relations Act</td>
<td>Labour Relations Act</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Conditions of Employment Act</td>
<td>Basic Conditions of Employment Act</td>
<td>Basic Conditions of Employment Act</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skills Development Act</td>
<td>Skills Development Act</td>
<td>Skills Development Act</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leave policy</td>
<td>Leave policy</td>
<td>Leave policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employment equity Act</td>
<td>Employment equity Act</td>
<td>Employment equity Act</td>
</tr>
<tr>
<td>Develop partnership and network with relevant stakeholders</td>
<td>-Maintain sound and sustainable relationship between employer</td>
<td>Keep contacts of the stakeholders</td>
<td>Keep contacts of the stakeholders</td>
<td>Keep contacts of the stakeholders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Draw up the service legal</td>
<td>Draw up the service legal</td>
<td>Draw up the service legal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Committees are established</td>
<td>Committees are established</td>
<td>Committees are established</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meetings attended with stakeholders</td>
<td>Meetings attended with stakeholders</td>
<td>Meetings attended with stakeholders</td>
</tr>
</tbody>
</table>
and employee
- Establish good relations with the end-users, suppliers, store personnel and other departments
- Attend meetings with the relevant stakeholders

agreement with various stakeholders

-Minutes and resolutions of various meetings
-Memo’s, letters and reports

General management of central warehouse, including the necessary reconciliation of stock purchased. Budget control
- Ensures utilization of the necessary stores documents, i.e. VA2, VA4, VA5, VA6, VA10, VA11A, RLS 01/02 etc.
- Monitor the application of the Occupational Health and Safety procedures

-PFMA (Act 1 of 1999)
-PPPFA (Act 5 of 2000)
-BAS, SAP, Medicon
-National Treasury regulations

-Proper procedures of the stores are maintained
-Ordering and dispatch forms are utilized
-Warehouses well monitored

9.2 State Accountant

<table>
<thead>
<tr>
<th>Key performance areas</th>
<th>Job Outputs</th>
<th>Job Standards</th>
<th>Job indicators</th>
</tr>
</thead>
</table>
| Receives requisition voucher from the warehouse (Z20 file containing VA4 & VA2) | Receives the 2 copies of the VA2 from the warehouse stores
- Inspect the Z20 file with the requisition forms
- Distribute the Z20 | - Provisioning Administrative System
- Supply Chain management manual | - Requisition forms received, inspected and distributed to the accounting clerks |
<table>
<thead>
<tr>
<th>Action</th>
<th>Steps</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receives store requisition/supplement (VA1) from the accounting clerks</td>
<td>- Inspect VA1</td>
<td>- Preferential Procurement Policy Framework Act (PPPFA)</td>
</tr>
<tr>
<td></td>
<td>- Approve the procurement of the requested items</td>
<td>- Public Finance Management Act</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Requested procurement approved</td>
</tr>
<tr>
<td>Inspection of VA10 (ledger book) to confirm goods received and compare with original requisition voucher</td>
<td>- Inspect VA10 as received from the transit in section</td>
<td>- Provisioning Administrative System manual (PAS)</td>
</tr>
<tr>
<td></td>
<td>- Filing of the VA 10 documents</td>
<td>- Supply Chain Management manual (SCMU)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Correctness of the requisition, documents verified, approved and filed</td>
</tr>
<tr>
<td>Ensure that the end user is notified about receipt of their request/goods/stock from the supplier</td>
<td>- Communicate with the procuring institutions about their available requests/stock</td>
<td>- PAS manual</td>
</tr>
<tr>
<td></td>
<td>- Advise the general assistants to deliver the ordered stock</td>
<td>- SCMU manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- End users informed about their requests/stock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Stock delivered to end users</td>
</tr>
<tr>
<td>Filing of the copy of the Z20 folder with requisition (VA1, VA2, VA4 and RLS01) documents</td>
<td>- Create proper filing system of the procurement documents</td>
<td>- PAS manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- SCMU manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Available filing system</td>
</tr>
<tr>
<td>Supervise all the personnel who are his/her subordinates and ensure cleanliness of the</td>
<td>- Management of human resources</td>
<td>- Resolution 1 of 2003</td>
</tr>
<tr>
<td></td>
<td>- Cleaning of the warehouses, offices and the</td>
<td>- Leave Policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Guidelines on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Supervising employees according to established principles</td>
</tr>
<tr>
<td>Store</td>
<td>Surrounding environment</td>
<td>Overtime payment</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>- PSCBC</td>
<td>- Occupational Health and Safety</td>
<td>- Proper filing of stores document</td>
</tr>
<tr>
<td>- Inspection of these documents</td>
<td>- PAS manual</td>
<td>- Stock is replenished in accordance to the re-order levels</td>
</tr>
<tr>
<td>- SCMU manual</td>
<td>- National Treasury Instructions</td>
<td>- Stock is replenished in accordance to the re-order levels</td>
</tr>
</tbody>
</table>

### 9.3 Warehouse Clerk

<table>
<thead>
<tr>
<th>Key Performance Areas</th>
<th>Job Outputs</th>
<th>Job Standards</th>
<th>Job Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receives requisition (VA2) from the end user and initiate ordering process</td>
<td>- VA4 completed and attached to the Z20 folder/file</td>
<td>- Knowledge of all applicable provision regarding relevant facts and regulations:</td>
<td>- Stock received from the supplier, recorded on the bin cards</td>
</tr>
<tr>
<td></td>
<td>- Send the Z20 file with attached VA2 &amp; VA 4 to store manager</td>
<td>- Public Finance Management Act</td>
<td>- Supervising the general assistants during the packing of stock</td>
</tr>
<tr>
<td></td>
<td>- Receive approved/signed VA2 from store manager</td>
<td>- PPPF Act</td>
<td>- Stock correctly issued to the relevant end user</td>
</tr>
<tr>
<td></td>
<td>- The fourth copy handed to the end user as proof of received VA2/requisition</td>
<td>- SCM manual</td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Details</td>
<td>Relevant Knowledge</td>
<td>End Result</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Ensure that the bin cards and the TPH 56 are updated              | - Inspect the stock levels and ensure that the bin cards correspond with the stock on hand.  
- Ensures that the VA2, VA10, VA11 etc. forms are correctly completed and correspond with the issued/received stock | - Provisions of relevant acts  
- Knowledge of all applicable policies, pre- scripts and practices  
- Professional and ethical codes of conduct | End users receive their stock at their expected times  
- Bin Cards are up to date  
- Batho Pele principles observed |
| Ensure that monthly, bi-annual and annual stock-take is completed  | - Stock take counting should be done twice a year  
- Final stock take should be in September and forwarded to the FPS Head Office Supply Chain | - Minimum Information Security Standards document  
- Knowledge of all applicable policies  
- Professional and ethical codes of conduct | Stock documentation correctly filled during supply  
- Stock well packed according to rules  
- Stock well delivered according to orders  
- VA2 and other stores forms filed |
| Verification of stock on hand and bin cards                        | - Stock verification should take place daily, monthly, and weekly        | - Basic Conditions of Employment act  
- Labour Relations Act | Effectively managed work output  
- Positive team dynamics |
### 9.4 General Assistant

<table>
<thead>
<tr>
<th>Key Performance Areas</th>
<th>Job Outputs</th>
<th>Job Standards</th>
<th>Job Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure that the warehouse are clean</td>
<td>-Using hands as well as the forklift for delivering of stock to the end users. Off-loading and packaging of the stock during delivery by the suppliers</td>
<td>-Receives payment copy &amp; VA1 -Usage of 0-9 filing order number system -Files are opened, orders inspected and signed -Record the info -Goods sent to warehouse</td>
<td>-Stock delivered and received by the end user -RSL02/VA2 signed by the end user</td>
</tr>
<tr>
<td>Ensure that the warehouse are clean</td>
<td>-Cleaning the warehouse using hygienic chemicals</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reporting any losses to the supervisor</td>
<td>-Loss management is practiced through reporting of any missing state property</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Assist other warehouses when a need arises</td>
<td>-Assist other warehouses during cleaning, off-loading of the stock during delivery, packaging of the stock and delivery to the end users</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Ensure that end users sign delivery documents</td>
<td>-After every delivery, it must be ensured that the</td>
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</table>
end user signs so that a signed document can be handed to the warehouse clerk

### 9.5 Accounting Clerk

<table>
<thead>
<tr>
<th>Key performance Areas</th>
<th>Job Outputs</th>
<th>Job standards</th>
<th>Jon Indicators</th>
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<tbody>
<tr>
<td>Completion of all tally cards</td>
<td>-Receive the 2 copies of the VA2 from the state accountant&lt;br&gt;-Completion of the requisition&lt;br&gt;-Sign VA1 and hand it over to the state accountant for approval of purchase of ordered items&lt;br&gt;-VA1 recorded in VA1 file/register and routed to the purchasing /buying section</td>
<td>-Record VA2 on the Z20 folder/file&lt;br&gt;-Control stock and value, by the VA10 form&lt;br&gt;-Assist with the disposal of items as per VA27 form</td>
<td>-VA2 requisition forms received&lt;br&gt;-Stores requisition completed&lt;br&gt;-VA1 registered in the VA1 register&lt;br&gt;-VA1 file sent to the buying section</td>
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<tr>
<td>Calculation of minimum and maximum stock levels</td>
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<td>-Usage of bin cards</td>
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<td>File orders according to family groups on a receipt</td>
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<td>-</td>
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<td>voucher</td>
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<td>---------------------------------------------</td>
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<tr>
<td>Issuing requisition from Medicom as per end user ordered</td>
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<tr>
<td>Replenishment of stock</td>
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<tr>
<td>Follow up RLS01 submitted to procurement office</td>
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<tr>
<td>Follow up late deliveries and queries as per memorandum from transit</td>
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<tr>
<td>Perform spot checks on a monthly basis</td>
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10 Appendix C: Current Layout of whole facility

10.1 Diepkloof
11 Appendix D: Item list

11.1 Yearly Quantities

<table>
<thead>
<tr>
<th>INVENTORY: Other Consumables (All cleaning materials/detergents) (March 2009-March 2010)</th>
<th>Roodepoort</th>
<th>Germiston</th>
<th>Sebokeng</th>
<th>PTA</th>
<th>Springs</th>
<th>Heidelberg</th>
<th>Diepkloof</th>
<th>Fochville</th>
<th>Johannesburg</th>
<th>Bronkhorstspruit</th>
<th>Ga-Rankuwa</th>
<th>Total</th>
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<tbody>
<tr>
<td>Hand paper towels (box)</td>
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<th>Germiston</th>
<th>Sebokeng</th>
<th>PTA</th>
<th>Springs</th>
<th>Heidelberg</th>
<th>Diepkloof</th>
<th>Fochville</th>
<th>Johannesburg</th>
<th>Bronkhorstspruit</th>
<th>Ga-Rankuwa</th>
<th>Total</th>
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</table>
### INVENTORY: Medical supplies (Gowns, masks, gloves, testkits) (March 2009 - March 2010)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Roodepoort</th>
<th>Germiston</th>
<th>Sebokeng</th>
<th>PTA</th>
<th>Springs</th>
<th>Heidelberg</th>
<th>Diepkloof</th>
<th>Fochville</th>
<th>Johannesburg</th>
<th>Bronkhorstspruit</th>
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### FPS 13

- 9
- 6
- 7
- 13
- 15
- 5
- 12
- 10
- 6
- 17
- 14
- 114

### FPS 183

- 6
- 5
- 8
- 10
- 12
- 8
- 15
- 3
- 6
- 9
- 11
- 93

### Note Book 3quire

- 7
- 6
- 5
- 3
- 9
- 12
- 10
- 8
- 3
- 14
- 10
- 87

### Note Pads

- 4
- 3
- 10
- 6
- 8
- 10
- 12
- 16
- 4
- 2
- 12
- 87

### Paper Clips – 78mm (box)

- 4
- 8
- 7
- 2
- 10
- 12
- 9
- 5
- 4
- 8
- 9
- 78

### Permanent Marker Black

- 13
- 6
- 7
- 12
- 4
- 9
- 11
- 5
- 4
- 9
- 10
- 90

### Permanent Marker Red

- 24
- 10
- 9
- 31
- 28
- 12
- 17
- 19
- 10
- 9
- 11
- 180

### Red Pens

- 15
- 14
- 19
- 22
- 24
- 16
- 11
- 9
- 14
- 18
- 16
- 178

### Staple Remover

- 0
- 1
- 1
- 1
- 1
- 0
- 1
- 0
- 1
- 1
- 0
- 7

### Stapler 26/6

- 3
- 3
- 3
- 5
- 4
- 2
- 3
- 5
- 4
- 2
- 3
- 37

### Staples – 1000

- 23/15
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0

### Staples – 5000

- 26/6 (box)
- 2
- 3
- 4
- 7
- 4
- 4
- 8
- 2
- 3
- 1
- 2
- 40

### Trip authority forms

- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0
- 0

### Whiteboard Marker – Assorted Colours

- 4
- 2
- 3
- 1
- 7
- 9
- 5
- 3
- 10
- 12
- 7
- 63

### Z8 Register

- 0
- 0
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- 0

**TOTAL**

- 279
- 0
- 997
- 0
- 0
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12 Appendix E: Sisense Prism Screenshots
13 References


Bartholdi, J.J.III & Hackman, S.T. 2008, Warehouse & Distribution Science, Release 0.89 Atlanta: The Supply Chain and Logistics Institute, School of Industrial and Systems Engineering, Georgia Institute of Technology.


Gilmore, Nate, 2009, Benefits of centralized inventory management, Practical ecommerce, pg 1-3


