Application of Lean Management in the Provisioning of Textbooks to Eastern Cape Public Schools

A thesis submitted to

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Doctor of Philosophy in Business Administration

by

Siyabonga Simayi

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Supervisor: Professor Thomas Koelble

DECLARATION

I declare that:

- this thesis, submitted for the degree Doctor of Philosophy in Business Administration at the University of Cape Town, is my independent work and has not been submitted by me for a degree at another faculty or university;
- all sources that I have used have been quoted and have been indicated and acknowledged by means of complete references.

Furthermore, I cede the copyright of my thesis to the University of Cape Town.

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Siyabonga Simayi (smysiy001)

August 2008

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ABSTRACT

The Eastern Cape Department of Education (ECDoE) has been mandated to provide lifelong, quality education and training opportunities to the population of the Eastern Cape Province (PSAM, 2004). The Department has been faced with numerous challenges including the basic requirement of providing textbooks to public schools.

This study is conceived to assess the apparently simple but very critical process of supplying textbooks in the Eastern Cape (EC) public schools. Lean Thinking and Value Stream Mapping (VSM) philosophies, a derivative of the Toyota Production System (TPS), was applied to evaluate the effectiveness of the current process and propose improvements as measured by reduced time and more effective support for learners. Further, usefulness of policies employed from 1998, such as South African Schools Act (SASA), National Standards and Funding Norms (NSFM) and LSM Review Report in ECDoE (2003), that relate to provisioning of textbooks were also assessed. Thirdly, the effect of the current provisioning process at school level was also investigated.

The factual information to answer the research questions was gathered using quantitative and qualitative techniques. The qualitative data was collected through partially-structured interviews with Provincial and district office Administrators, to gain insights into the process of supplying textbooks and the potential effects of implemented policies. Quantitative data was collected to assess the effect of the current supply process at school level.

The results showed that decision making in respect of the choice of textbooks, lists of suppliers to be used and the process to be followed for the procurement of books takes place mainly in the Head Office. This suggests that the education system reform through SASA in 1998 and decentralization process initiated in 1999 to improve delivery has not been effective to better the supply of textbooks. Thus, the process of supply still remains centralized, process steps and lines of authority sometimes not outlined and the definition of responsibilities are not always clear which contribute to inefficiencies.

From the surveyed schools, the proposed direct relationship between schools and publishers/suppliers supports the decision making that is closer to schools by allowing them the choice of textbooks from an approved list of suppliers. The choice from both publisher and supplier list would assist schools and suppliers to meet local needs as they are better placed than the remote Head Office. The approved supplier list should ascertain economies of scale which would allow negotiations for discounts from suppliers, and also ensure the implementation of relevant procurement legislation such as Public Financial Management Act and Preferential Procurement Policy Framework Act.

The findings further show that Lean Thinking philosophies, such as the five rules of TPS and VSM, can be employed in a service environment to identify non-value adding activities or *muda* (waste in Japanese) in the process of provisioning of textbooks to schools in the Eastern Cape. The highlighted 25% reduction in time and improved clarity in the ordering process gives a strong evidence for the value of this study which are attributable to:

- District office functions do not add value to the process of supplying textbooks. These offices only distribute information and material between schools and the Head Office. There is a 6 week period saving in time that result from schools and the head office on communicating directly and not via the district offices. In 2004, there was unfortunately a grave lack of computers and e-mail facilities within Eastern Cape schools (ECDoE, 2006) that would have represented a severe challenge for direct communication process. However, other communication mechanism such as facsimile machines for instance can be used for direct linkages which are available in most public schools in the Eastern Cape.
- The stage of capturing and processing orders can be halved by employing temporal personnel on time with preference being given to those that are computer literate. In the future, if three full time administration personnel can be employed permanently, the ECDoE can build the required skills and enhance institutional memory, thus achieving continuous improvement which is rule 5 of the TPS and VSM principles.

- Specifying the exact next customer in the chain. It is not enough to identify the district office as next in the chain but to indicate a specific contact in the district office, to prevent delays and safeguard against requisition forms being missing and getting lost.
- Creation of a response mechanism that ensures that information or material has been received by the correct person. This will lessen unnecessary ad hoc or "mop-up" requisition orders.

This thesis demonstrates that the research questions were answered by illustrating that the system introduced as from 1998 has not been effective in the process of provision of textbooks by the Department to schools. The thesis demonstrates that the 5 principles of the TPS and VSM can be used for the following:

(a) to describe the processes of supplying textbooks within the ECDoE public schools arena;

(b) to clarify the material and information flow between the role players, namely the Administrators in the Head Office (Zwelitsha), District offices and Schools in respect of the supply and distribution of textbooks;

(c) to identify non-value adding activities (waste) and, based on the findings, recommend improvements; and

(d) to contribute to the improvement of the process of supply of textbooks to Eastern Cape public schools, as measured by reduced time.

The level of efficiency in the process of supplying textbooks eventually affects the end-users, schools and their learners. There is statistical evidence from the surveyed schools that the delivery time of books to schools and the availability of textbooks for learners impact the Grade 12 pass rate. However, there is no statistical evidence that the time schools take to return the requisition forms to the district office has a direct impact on the Grade 12 pass rate. It is clear that the efficiency of the process of supplying textbooks improves a school's Grade 12 pass rate, thus assisting the ECDoE to improve its performance and the service it gives to its citizens in the Eastern Cape.

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ACRONYMS

DET – Department of Education and Training to serve former black schools prior 1994

EC – Eastern Cape Province in South Africa

ECDoE - Eastern Cape Department of Education with head office in Zwelitsha

LSM - learner support materials which textbooks constitute 80%

NDoE – National Department of Education of South Africa

PASA – Publisher's Association of South Africa

PED – Provincial Education Department

PSAM – Public Service Accountability Monitor, a research unit based at Rhodes University

SADTU - South African Democratic Teacher's Union

SASA - South African Schools Act, Number 84 of 1996 (as amended)

SGB - School governing body as defined by SASA

TPS - Toyota Production System

VSM – value stream mapping, a lean thinking tool to measure efficiency of the system

CHAPTER 1 – INTRODUCTION, PROBLEM STATEMENT AND CONTEXT

1.1 BACKGROUND

The South African government has embarked on the development of an education system that seeks to enfranchise its citizens. By addressing the inequalities of the past, the majority of black people would now be given access to an education commensurate with their skills, thus equipping them to function at all levels from skilled worker to managerial and professional so that they are active and informed democratic citizens (Fiske and Ladd, 2004). The separation strategy of the old apartheid system left most black people "under-educated, under-skilled and under-prepared for full participation in social, economic and civic life"(Fiske and Ladd, 2004). The educational aspirations of the political ruling party, African National Congress (ANC), were also embodied in Section 29 of the new South African Constitution: "Everyone has the right to a basic education, including adult basic education, and to further education, which the State, through reasonable measures, must make progressively available and accessible." The right to a basic education applies to all persons, including learners and adults alike.

A first step after 1994 was to integrate the education and training systems implemented by the past regime (Sayed and Jansen, 2001). Provinces such as the Eastern Cape, Limpopo, and KwaZulu-Natal represented an aggregation of former homelands or territories with pockets of previously privileged white South Africans in a sea of under-developed Blacks. Therefore, the challenges for these provinces were far greater. Not only did they have to establish new local and provincial governments essentially from scratch, but they also had to combine the cultures of a variety of administrative structures, some of which had been dysfunctional before (Sayed and Jansen, 2001). This resulted in nine new provinces that differed significantly in their political and managerial capacity. There were also large differences in their wealth and education-related assets, the educational attainment of their populations and the quality of their school facilities.

It has been acknowledged by many writers such as Sayed and Jansen (2001), Jansen (2000), Fiske and Ladd (2004), Soudien (1998) and Public Service Accountability Monitor (PSAM, 2004) that the education system at the primary, secondary and higher education levels faced enormous problems related to the legacy of apartheid. These problems included limited resources, managerial incapacity, financial mismanagement, poor teaching and low achievement in institutions serving mainly black students.

Amidst the said systematic barriers, the Eastern Cape (EC) provincial government has the mandate to deliver a life-long, empowering education to the citizens of the Province (Cole, 1999). However, the perpetual challenges surrounding service delivery such as provision of learner support material (LSM) undermines this noble intent. The focus of this study was to evaluate if the Eastern Cape (EC) education policies are effective in the provisioning of textbooks. Secondly, the study went on to evaluate a typical relevant scenario, namely the process of supplying textbooks, to illustrate the performance of the EC education system. The effectiveness of this supply process was measured and assessed using Lean Thinking and Value Stream Mapping (VSM) to reveal step by step process and any bottlenecks in the system, and to suggest improvements. In order to accomplish these research objectives, this chapter will illustrate the contextual setting, background, what the study seeks to achieve and how the investigation was conducted.

1.2 INTRODUCTION AND PROBLEM IDENTIFICATION

> *Lack of textbooks and other teaching supplies is a general problem. "The government is supposed to provide textbooks, but sometimes it fails to do so," reported Victoria Mabengu, senior teacher at the Umtata Community School, which has 21 educators for nearly 1,100 learners. "We have one class that has 20 books for 140 learners. Sometimes we order one book but get another."*
>
> Source: Fiske and Ladd, 2004

The Eastern Cape Department of Education (ECDoE) has been mandated to provide lifelong, quality education and training opportunities to the population of the EC Province (PSAM,

2004). One of the difficulties faced by the EC Province is that it is an aggregation of three previous distinct entities, a section of the Republic of South Africa, Ciskei and Transkei, with their dysfunctional bureaucracies. This was evident by the level of poor infrastructure, lack of financial and management systems, inadequate funding particularly in Ciskei, Transkei and mainly black schools in the Republic of South Africa. This left a legacy of three different types of governance, style of government, culture, infrastructure, objectives and competencies. Secondly, the Province is relatively large in terms of its geography and population. This may have an effect on the speed and quality of service delivery. Thirdly, the EC is the second poorest province in South Africa, hence it lacks financial support from citizens and its poor infrastructure directly inhibits efficient service delivery, (StatsSA, 2007). Fourthly, there is a huge gap between the rich and poor. This is mirrored in the difference between rural schools, township schools and former-model C or suburban schools (StatsSA, 2007).

A team sent by the National Department of Public Service and Administration visited the EC in 1999 to assist the Department of Education in developing a strategic plan, a new organizational structure, a plan for improving service delivery and a human resource plan (PSAM, 2004). The team concluded that the hierarchical and centralized structure set up in 1997 that included six regional offices and forty-one district offices was obsolete and nonfunctional and needed to be replaced. The new plan was to have a central office that focused more on policy development and planning and the formation and co-ordination of twenty-four new district offices that would be responsible for delivering education services including provisioning of textbooks to the citizens.

Though much of the new structure had been implemented by 2001, serious problems remained. For instance, five months into that school year in 2002, school supplies that had been promised at the beginning of the year had still not arrived in one part of the Province, prompting more than 60,000 pupils to boycott classes (PSAM, 2004). The same problems persisted even after the implementation of the recommended plan. The PSAM reports from 2002 to 2005 indicate the following challenges in the EC education system:

- There were number of vacancies for Education Development Officers (60%) and Subject Advisors (70%), who are responsible for servicing the district's schools. This resulted in district offices being unable to extend effective support to schools;
- The district offices' organisational structure and administrative arrangements hampered efficient and effective service delivery. Lines of authority and the definition of responsibilities are not always clear. There are gaps in lines of communication between provincial and district offices and the schools and learners that the Department seeks to serve;
- There was gross under-spending resulting from inadequate planning and procurement processes. For example, in a 2004 sample testing of expenditure transactions revealed that "goods and services amounting to R31.21 million were not procured as a result of a fair and error free process." In addition, the South African Auditor-General noted that proper tendering procedures were not followed in every instance and that "the possibility of collusion, fraud and corruption" could not be excluded;
- The files used in the district offices had out of date personnel and inaccurate salary system coupled with poor leave records;
- The Department failed "to produce all supporting documentation, personnel and other files, vouchers, housing guarantees and other documentation" for audit purposes. This problem has been reported by the Auditor-General since 1995. It is a contravention of Section 41 of the Public Finance Management Act, 1999, Act No. 1 of 1999 (PFMA) and constitutes financial misconduct;
- Poor asset management and inadequate loss control function;
- Unauthorised bank overdrafts and failure to monitor transfer payments;
- Poor quality of in-year management and monthly/quarterly reports;
- Lack of and unbudgeted textbooks;
- Inadequate document management system;
- The processing of personnel payment backlogs by the Department has taken place since 1999, when the Department failed to pay substitute and temporary educators. The failure by the Department to pay teachers timeously has resulted in the Department incurring unwarranted extra expenditure emanating from interest that accumulates on outstanding

payments. There were also double payments that are made to educators who abuse the payment system by submitting fraudulent duplicate claims.

It is evident that the challenges above are mostly related to managerial incapacity and how the processes are set out and managed (Annual Report ECDoE, 2004). The focus of the study was the evaluation of the process of provisioning textbooks to public schools and whether the policies for supply of textbooks such as South African Schools Act (SASA), National Standards and Funding Norms (NSFM), LSM Review Report in ECDoE (2003), are effective and efficient. The effectiveness of the process was measured and assessed using Lean Thinking and Value Stream Mapping (VSM) to uncover step by step process and any bottlenecks in the system, thus suggest improvements. Thereafter, the study investigated the effects of the adequacy of the supply at school level and used the Grade 12 pass rate as a proxy of school's performance. In order to accomplish the said research objectives, this chapter will illustrate the problem, the contextual setting, background and how the study will address the research questions.

1.3 RATIONALE AND MOTIVATION

The major motivation for embarking on this study is to provide a perspective on the logic of democratic education policies and the means of implementing them in the post colonial, post-apartheid context in the Eastern Cape, South Africa. The debate concerning the inability of the post-colonial governments to address pressing social and economic problems in Latin America, the Caribbean, Asia and Africa is a well publicised one (Elyachar, 2003; Escobar, 1995; and Ferguson, 1994).

Decentralization as a thrust of Eastern Cape education system has been fostered by many democratic governments (Winkler, 1999). It is intended to bring education closer to the learners who are the "customers". Balanced education policies are complex and can result in major changes in the way many school systems operate especially in regard to policy making, generating revenues, spending funds, training teachers, designing curricula and managing local schools (Fiske, 1996). Such changes imply fundamental shifts in the values that concern

the relationship of learners and parents to schools, relationships of communities to central government and the meaning of public education (Fiske, 1996).

Therefore the major research question is: how do we account for the lack of progress toward a more egalitarian and democratic education system in South Africa under its current ANC government? Why has the ANC provincial government of the Eastern Cape, which has on many occasions declared its commitment to the egalitarian and democratic goals set by its national counterpart, failed to provide school textbooks to its public schools in a timely fashion, thereby hindering the educational process of the pupils? The study focussed on three areas:

(i) To determine if the implementend policies support effective provisioning of textbooks;
(ii) To measure the process of provisioning of textbooks to schools using Lean Thinking tools and VSM; and
(iii) To assess the effect of an efficient system of textbook supply at school level.

1.4 HYPOTHESES AND RESEARCH QUESTIONS

The study aims at informing the policy makers in the ECDoE about the quality of service delivery regarding the supply of textbooks to public schools. Only secondary schools with Grade 12 were considered for this study as their outcomes can be easily measured and are published annually. The research questions include:

Q1: How does the implemented policy for the delivery and supply of textbooks to schools by the ECDoE assist in the efficiency of the supply?

Q2: How can Value Stream Mapping (VSM) be used to describe the process of supplying textbooks in the ECDoE public schools?

Q3: How can VSM be applied to expedite the material and information flow between the role players, namely Administrators at the Head Office (Zwelitsha), District Offices and schools in the supply and distribution of textbooks?

Q4: How can VSM be used to identify non-value adding activities (waste) and, based on the findings recommend improvements?

Q5: How can the application of Lean Thinking principles, philosophies and tools contribute to the improvement in the supply of textbooks to EC public schools, as measured by reduced time in the system?

The success or failure of service delivery, such as the provisioning of books to schools by the ECDoE, is ultimately assessed by the quality of the education received by the learners as determined by the pass rate in Grade 12. Hence, to elaborate on the primary questions above, sub-sets of the problems that link the supply of textbooks and the Grade 12 pass rate have been developed through these research hypotheses:

H1: An increase in the number of learners without textbooks has negative impact on the Grade 12 pass rate;

H2: A decrease in the time (measured in weeks) that schools take to return the requisition forms to district offices for textbooks can improve Grade 12 pass rate;

H3: A decrease in the time taken (measured in months) to deliver textbooks to the schools has a positive impact on the Grade 12 pass rate.

1.5 EXPECTED CONTRIBUTIONS OF THE RESEARCH

The value of this research is categorised in terms of theoretical, methodological and practical perspectives.

1.5.1 THEORETICAL VALUE

The research distilled a variety of Lean Thinking literature sources and organised and compared divergent views in the supply of textbooks to public schools within the Eastern Cape.

The research brings together two bodies of knowledge by integrating education system and Lean Thinking philosophies. In doing so, the research will make a unique contribution to the current level of knowledge about the objects of the study as it attempts to improve the process of provisioning textbooks to schools.

The theoretical value will be on the evaluation of policies and the processes inherent in Eastern Cape provincial education system regarding the supply and distribution of textbooks. The assessment of policies is done to ascertain if they assist/support the process and how they compare to international ones. Further, the theoretical contribution is an assessment of how a manufacturing tool, namely Lean Thinking philosophy, can be used in a service industry such as an education department.

1.5.2 METHODOLOGICAL VALUE

The methodological contribution of the research will be contextually aligned to and empirically validated by the application of Lean Management and Value Stream Mapping (VSM). The Lean Thinking philosophy, a derivative of Toyota Production System (TPS) according to Womack and Jones (1996), Womack and Jones (2005) and VSM from Rother and Harris (2001), will be used to measure the process, its flow, identify bottlenecks and recommend areas of improvement to shorten the time for the provisioning of textbooks. The interviews conducted with ECDoE personnel were used to assess the efficiency of the actual process. Also, the questionnaires issued to schools were used to determine the impact of the supply of textbooks on the performance of the schools. Modes of Inferences and Statistical Analysis were used to depict tendencies, common themes and patterns in the data so as to make statistical estimates and inferences in similar environments.

1.5.3 PRACTICAL VALUE

It has been determined that the results of the research findings can be applied in practice in similar environments. Wood (2004) and Chalice (2005) pointed out that Lean Thinking tools and VSM can be used in a service industry to uncover process inefficiencies and non-value adding activities. The analysis on the established policies can be used to measure the effectiveness of education system in the supply of textbooks. The study achieved practical value by measuring the process of provisioning of textbooks. The process commences in the Provincial office and continues in the district

office finally reaching the schools. The Lean Thinking philosophy, particularly VSM, was employed to uncover non-value and value adding activities and information for each step in the process. The tool reflected the bottlenecks, problems, restrictions and enablers as measured by process simplification, response, clarity and time. Therefore, the research can make recommendations to reduce the time for the supply of textbooks. It should be noted that the study was not designed to assess or evaluate the shortages of textbooks in schools, even though shortages can be a consequence or can be affected by the inefficient supply of textbooks. The study will also be made available to EC Education policy makers.

1.6 DEFINITIONS OF THE RESEARCH BOUNDARIES

The research has been conducted to measure seemingly simple but key deliverable by the Department in the education system, the process of supply and distribution of textbooks to schools in a democratic and decentralized political environment. The study was restricted to the ECDoE and data collection for analysis was done within the EC public secondary schools with principals or LSM coordinators and Administrators from both the Head Office in Zwelitsha and district offices throughout the province.

The term Learning Support Materials (LSM) can refer to almost any item in the school besides the buildings and the teachers. Most South African LSM research and subsequent reports have tended to concern themselves with 'traditional' materials that are ordered on an annual (or more frequent) basis, such as textbooks, other print curriculum-based materials used by learners and teachers, and stationery (LSM Review Report, 2003). There has been very limited or no focus on 'non-traditional' materials, such as consumable materials, library materials, teaching equipment and LSM that specifically addresses learning requirements. This report concerns itself mainly with the traditional materials based on the curriculum and aimed at mediating between teachers and learners, namely textbooks, teacher guides and readers. According to the LSM Review Report (2003), textbooks form over 80% of LSM, thus in this research, the term LSM will be used interchangeably with textbooks.

1.7 CONSTRAINTS OF THE RESEARCH

The availability of published work on the supply of textbooks to ordinary schools is limited. There is also limited published work on the application of Lean Thinking and VSM in the education system and even scarcer work on the supply of textbooks to schools. These deficiencies undoubtedly constitute a weakness, but this is not surprising since Lean Thinking is a relatively young and developing science tool for service industries. Although education policies for provisioning and supply of textbooks to secondary public schools is a well published phenomenon, however studies to measure the process, step by step, inefficiencies and wasteful areas are not available especially as assessed by Lean management. The literature of institutional set-up is conceptually, empirically and methodologically inadequate on the delivery and supply of textbooks to schools both in South Africa and abroad.

1.8 LITERATURE REVIEW

South Africa has taken the approach that the role of education is to improve participation of citizens in the landscape of democracy, legitimating equality and as a weapon of change (Fiske and Ladd, 2004). Neither approach on its own is entirely satisfactory since South Africa continues to struggle to delivery optimum quality education to schools. The literature for the study is mainly divided into two areas as discussed below.

1.8.1 POLICIES THAT GOVERN THE SUPPLY OF TEXTBOOKS TO SCHOOLS

The persistent challenges surrounding the education system including the provision of learner support material, hamper the effectiveness of the Department in its delivery mandate. This research seeks to focus on the process effectiveness and identify key constraints in the distribution and supply of textbooks to public schools within the EC. There are policies in place to guide the distribution and provisioning of textbooks to schools and studies that have been undertaken subsequently. The relevant policies include South African Schools Act (SASA), National Standards and Funding Norms

(NSFM), LSM Review Report in ECDoE (2003) would be reviewed to assess the effectiveness of the supply of textbooks. The relevant studies such as Financial and Fiscal Commission (FFC) in 2005 and KwaZulu Natal Province case study were also considered.

According to the FFC 2005 report, only 45% of Grade 6 pupils had reading textbooks and 40.5% had math textbooks and 90% of these Grade 6 pupils are from the former Department of Education and Training (DET) schools, which were former African schools. The Commission was established to improve the accountability of the Departments of health, education and social services in distributing funds between national, province and local levels of government. The FFC undertook an investigation in 2003/4 on the provision of LSM to schools and the report highlighted many problems that the education system faces. However, the report was based on a very small sample of schools (22) and three provinces were surveyed, Eastern Cape, Free State and Western Cape. In its submission, the FFC commented on the financing of LSM. The comments were based on an initial study that indicated inadequate and erratic expenditure on LSM. The areas and questions addressed to schools covered:

- the availability of textbooks;
- the supply of LSM;
- the causes of textbook shortages;
- per learner textbook allocations;
- the lifespan of textbooks;
- the textbooks buying cycle;
- the control of learner support materials in schools; and
- school funding choices.

The Department's configuration and functions as pertaining to key processes, decision makers, technologies as stipulated in SASA, NSFM and LSM Review Report in ECDoE (2003), will also be examined to determine if they inhibit or enable the supply and distribution of books to schools.

1.8.2 LEAN THINKING AND VALUE STREAM MAPPING

Lean Thinking, adopted from the Toyota Production System (TPS), which is a manufacturing tool, was used to map the process in order to identify role players, value adding and non-value adding (waste) activities and information on the process. The identified waste or non-value adding activities in the mapping were measured by time saving or wasted. Thereafter, the study makes recommendations to improve the system by reducing the time it takes for the books to reach the schools.

The Lean Thinking system is not only applicable for routine production work but could also be applied in service functions like equipment maintenance, workers' training and supervision, logistics and materials handling, process design and redesign (Chalice, 2005; Wood, 2004). Hence it was applied to the supply of textbooks for this research.

The term Lean thinking was first defined in the 1990's in a book called *The Machine that Changed the World: The Story of Lean Production* (Womack and Jones, 1996). The book describes that Lean Thinking principles are based on the Toyota Production System (TPS). Womack and Jones (1996) identified five core Lean Thinking principles, which are:

1. Specify value in the eyes of the customer;
2. Identify the value stream and eliminate waste;
3. Make value flow at the pull of the customer;
4. Let customer "pull" value from the enterprise; and
5. Continuously improve in the pursuit of perfection.

VSM is a visual aid that describes the various stages in the consumption and production processes (Rother and Shook, 1999). VSM is effective in detecting waste (*muda*) that is generated in a supply chain and hence assists in achieving a lean supply chain (Womack and Jones, 1996). The value stream is the set of all the specific actions required to bring a specific product, whether goods, a service or increasingly a combination of the two

(Womack and Jones, 1996:19) to the market place and the customer. This can be achieved by the three critical management tasks of any business:

(i) the problem-solving task running from concept through detailed design and engineering to product launch;
(ii) the information management task running from order-taking through detailed scheduling to delivery; and
(iii) the physical transformation task starting with raw materials and progressing to a finished product in the hands of the customer.

This research focuses largely on service delivery by the ECDoE and thus will employ and measure mainly the information management task from the ordering of textbooks until their delivery to the EC public schools. It should be noted that no physical transformation or limited problem-solving tasks will be measured in this study.

1.9 RESEARCH METHODOLOGY

The research is ex-post facto in nature, conducted primarily through desk research from relevant literature, semi-structured interviews with ECDoE administrators and survey questionnaires sent to secondary schools within the EC. A combination of quantitative and qualitative techniques was used for data collection and analysis and emphasis was placed on common trends, lessons and themes that became apparent especially those factors that saved or wasted time in the process of supplying of textbooks.

Ex-post facto research, according to Landman (1988), is used to refer to research which the researcher, rather than creating the testable scenario, examines the effect of a naturally occurring scenario after it has occurred. In other words, it is a study that attempts to discover the pre-existing causal conditions between variables or groups.

This type of research is not without its shortcomings and only partial control is possible. Ex-post facto research involves a contrast and comparison of observed variables or groups. The scenario cannot be manipulated, since it has already occurred (Mouton and Marias, 1990). The measured or assessed process is historic as the actions of distribution and supply are

already in the past. The measure of the effectiveness of established policies to facilitate the supply of textbooks was also historic as it evaluated past practices. There were three major methodologies used to collect the data and information required to answer the five research questions and three hypotheses.

(a) Desktop research was employed through published work and the collection of DoE documentation and statistics to assess education policies and Lean Thinking theory and how that was applicable in the case of the EC education system. The relevant DoE documentation for qualitative and quantitative data was used to support the empirical methodology of interviews and survey questionnaires.

(b) In addition to the documents referred to in the Literature Review section, any documents that were relevant were used for analysis, for example the ECDoE annual reports, Eastern Cape Department of Finance annual reports, Auditor General's annual reports, PASM and South African Schools Act (SASA), National Standards and Funding Norms (NSFM) and LSM Review Report in ECDoE (2003). Any unusual term and or phrase that might be used will be defined within this document.

(c) Semi-structured interviews with ECDoE Administrators are an indication of a qualitative method that was used to identify the steps of the process of supply from the DoE until textbooks reach learners (schools). The interviews were also used to gain insight into the decentralization of the education system. The questions for the interviews were prepared by the writer and approved by the Supervisor, refer to Appendix 1.

(d) Surveys were conducted in sampled schools through structured questionnaires were sent to a sample of public secondary schools in order to obtain quantitative data to assess the effects of the process of the supply of textbooks, refer to Appendix 2. There are two groups of schools that were surveyed, formerly model C (suburban) and former black only or DET schools. In terms of the locations of the schools, with blacks from townships and suburban multiracial schools that are former model C schools. Schools from rural areas had both categories of formely blacks and former models C.

The three basic questions Remenyi (1996) poses are: why ought this research be done? What is to be researched? And, finally, how is the research going to be conducted in terms of its methodological approach?"

To evaluate how this research has contributed to the existing body of knowledge, an account of the way chosen to reach the documented outcome will be stated and the what the research is all about out must be clearly stated. The "what" and "why" parts have been stated in this chapter, and Chapter 4 gives a detailed analysis of "how "the research was conducted.

After the data collection through literature review, semi-structured interviews and survey questionnaire, both statistical and normative (descriptive) forms of data were provided.

The data to study education policies and the process of provision textbooks which would be assessed by Lean thinking were gathered through qualitative semi-structured interviews. Creswell (1994: 1-2) describes a qualitative study as "an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting". The Modes of Inference method of analyzing qualitative data was employed. Danermark, Jakobsen and Karlsson (2002) describe inferences as logical preconditions of scientific reasoning, thus the core of the scientific method.

Hopkins and Antes (1990:258) are of the opinion that a structured questionnaire provides a mechanism to collect personal information from respondents that may not be so readily obtainable from other methods. According to Charles (1992:69), in empirical research, data is obtained in the form of scores, which can be tabulated and analyzed. A common instrument for observing data beyond the physical reach of the observer is the survey questionnaire, a totally impersonal probe.

The purpose of quantitative research is to make objective descriptions of a limited set of certain interventions (Mouton, 1999). Thus, quantitative studies of a research problem typically involve a precise description of the phenomena and a search for pertinent variables and their interrelationships. Ultimately, a theory is formulated to account for the empirical findings (Borg, Gall and Gall, 1993:195-196). Statistical analysis was utilized to analyse the

received 30 responses. The statistical instruments that were used include: descriptive statistics, Analysis of Variance (ANOVA), Linear regression model, Pearson Chi-Square Test and Pearson Coefficient of Correlation.

1.10 LAYOUT OF THE THESIS

Chapter 1 Introduction and contextual setup- gives the setting of the research. It further reflects on the problem statement and approach used to solve the problem. In this chapter the problem definition, objectives and research hypotheses are stated.

Literature review

Theoretical perspective and document analysis from other sources and case studies of other countries. This chapter reviews the literature on the various ways to study and compare and contrast the supply of textbooks to schools.

Chapter 2: Policies that govern supply of textbooks in schools

Chapter 3: Lean thinking

Chapter 4 Research design and methodology. This chapter covers data collection, analysis, synthesis and reporting by discussing the research design, participants, samples, measurement instruments, research procedures, analytical and statistical techniques and hypotheses.

Chapter 5 Findings and discussions. The results and findings of the research will be reported, discussed and interpreted according to objectives of the empirical study.

Chapter 6 Conclusions, recommendations and future studies. In this chapter conclusions and recommendations are made on the results of both the empirical data and literature research. Areas that were not analysed were identified and proposed for future studies.

Reference List – All referenced documents or information sources are stated in the reference list to acknowledge their contribution to the study as per Harvard referencing style.

Appendices – Appendices to the research body.

1.11 SUMMARY

In this chapter the problem statement, objectives and research questions and hypotheses were discussed. The research was set out to investigate the process of supplying textbooks to public schools within the EC. The measured dependent variable was the time it takes before the books reach the end users, the schools. Lean Thinking and VSM were employed to measure this process. It was recognized that the provisioning of textbooks process takes place in the context of a decentralized education system that could assist or inhibit the Department's performance. Therefore the research investigated three areas, the friendliness of the implemented supply policy to the provisioning of textbooks; process of provision of textbooks to schools using Lean Thinking tools and VSM; and the effect of textbook supply at school level.

It should be indicated that the study did not set out to assess or evaluate the shortage of textbooks in schools, even though shortages can be a consequence of or can be affected by the inefficient supply of textbooks.

CHAPTER 2 –POLICIES GOVERNING SUPPLY OF TEXTBOOKS TO EASTERN CAPE SCHOOLS

2.1 BACKGROUND

The rationale for education decentralization system in South Africa involves improving efficiency, effectiveness and democracy (Fiske, 1996). Improved equity too, is a rationale for decentralization, although it is also often acknowledged that, because decentralization makes localities more reliant upon their economic and social endowments, some aspects of equity may suffer in the absence of adequate compensatory mechanisms. What is equitable may not be efficient, what is efficient may not be democratic, what is democratic may not be equitable (Pascoe and Pascoe, 1998). In practice, reform strategies should attempt to optimize the sometimes inevitable trade-offs between efficiency, equity, and democracy while seeking to improve on all three (Pascoe, 1998). The actual design and implementation of education policy reforms are inherently political processes; thus decisions about making these trade-offs rightly occur in the political arena (Gershberg, 1998). Gaynor (1998) in a World Bank study has noted that most countries have aligned their education offices to local governments or municipalities, which is not the case in South Africa. The relevant policies that were implemented by the Eastern Cape province for provisioning and supply of textbooks include South African Schools Act (SASA), National Standards and Funding Norms (NSFM), LSM Review Report in ECDoE (2003) will be assessed on their effectiveness and practices in this study.

2.2 INTRODUCTION

In South Africa, the education expenditure responsibilities have been transferred to the Provinces, of which the Head Office for EC is in Zwelitsha. The ANC led government wanted to decentralize to legitimize an education system which was fuelled by the slogan “power to the people”. The process was also seen as a way to improve equity in schooling (Fiske and Ladd, 2004).

The government has faced many challenges relating to accountability and management of schools. As Taylor (2002) says, "the new government inherited a system of education in which the authority of the state had been steadily eroded over a period of two decades by mass grass roots level protests." An additional challenge in the EC that arose with provincial control over education was the apparent overspending of R 1 billion identified in 1997 (Cole, 1999). The basic cause of overspending emanated from the requirement criteria such as maximum pupil-teacher ratios and nationally-negotiated teacher salaries (DoE, 2002). Since 1994, the proportion of the central budget allocated to education through the Provinces has risen sharply, this increase was absorbed entirely by hiring new teachers and paying them more. Part of the challenge in the EC education system is the provisioning and management of the distribution of the textbooks to public schools, which ultimately affects learning and teaching in the classrooms.

This document focuses on the effectiveness of the distribution process and supply of textbooks to public schools in the Eastern Cape. It seeks to unveil key setbacks that affect public schools within the province and explains why so many pupils have to make do without textbooks for prolonged periods of time while at school. This document focuses on the effectiveness of the distribution process and supply of textbooks to public schools in the Eastern Cape. It seeks to unveil key setbacks that affect public schools within the province and explains why so many pupils have to make do without textbooks for prolonged periods of time while at school. According to the FFC Report (2005), only 45% of Grade 6 pupils had reading books and 40.5% had math textbooks at their disposal. Moreover, 90% of these deficiencies were found to be in former African schools. This study attempts to identify process setbacks and propose ways to improve the inefficient supply and distribution of textbooks which contributes to the shortages particularly in the former black schools. This chapter discusses policies and different legislative enablers that directly affect provisioning of textbooks to schools that were introduced after 1994 and these are discussed below.

2.2 NORMS AND STANDARDS FOR SCHOOL FUNDING

The *Norms and Standards for School Funding* was introduced in 1998 to give effect to the funding provisions for public schools in the South African Schools Act (SASA). The Schools Act aims to redistribute recurrent non-personnel resources to the neediest learners within each Province to improve equity, thus achieving equality in the long-term. Such funding makes provision for three categories of expenditure, namely maintenance of school buildings, municipal services and utilities ;and LSM. Funding for each these three categories is allocated on a per learner basis. One of the important funding provisions in the policy is set out in paragraph 117 of the Act, which states that schools should provide each learner with a basic package of at least R100 for LSM. If funds are insufficient to make this allocation to all learners, the Provincial Education Departments (PED's) must prioritise expenditure for the neediest learners. This policy demands that PED's distinguish between schools on the basis of the socio-economic status of learners as well as differences reflecting broader physical conditions at schools. Once schools have been ranked according to these indicators of need, resource allocation is undertaken on a progressive scale benefiting the poorest learners in each Province. PED's are required to produce a "Resource targeting table" based on schools' ranking on these two factors to enable a *progressive* redistribution of funding to the poorest schools, refer to Table 1 below.

According to the DoE 2003 Annual Report, most PEDs, including the Eastern Cape, are challenged by the total size of the funding required to redress the unbalanced allocations, given the small share of non-personnel expenditure in provincial budgets (DoE Annual Report, 2003). This constraint severely restricted the ability of most Provinces to effect a meaningful redistribution of funds to the majority of the poorest learners. The exceptions are Gauteng and the Northern Cape, which have relatively larger non-personnel bases. The average per learner expenditure distributed by the Norms and Standards mechanism in these provinces is R184 and R275 respectively, which far outstrips comparable allocations by other PEDs, refer to Table 2 below. The average per learner expenditure in KwaZulu-Natal, for example, was only R35 in 2005/6 fiscal year.

Provinces generally responded to this challenge by proposing a division of available funds that is in line with the policy suggestions of the Norms and Standards. This meant that Resource Targeting in the Western Cape, North West, and Mpumalanga made clear

distinctions not only between rich and poor learners, but also amongst poor learners themselves. Many poor learners and schools that did not fall in the top re-distributive bracket received an average per learner allocation. This approach does not negate the use of broad categories, but it means that per learner expenditure in a specific category is different for each school. This reduces contestations by public schools about their resource allocations and clearly takes into account the small differences that separate learners and schools. Other Provinces that grouped schools into broad categories allocated the same per learner amounts to each school falling into each category. The national DoE argues that it is the prerogative of a PED to choose its redistribution mechanism, although evidence shows that the use of a continuous scale offers greater sophistication and promotes re-distributive justice in the allocation of resources. The Eastern Cape allocates resources as indicated in Table 1 below.

Table 1: Resource targeting based on condition of schools and communities in the EC

School Quintile	Expenditure Allocation	Cumulative % of Schools	Cumulative % expenditure	Per learner expenditure in EC (2007)
Poorest 20%	35% of all resources	20%	35%	554
Next 20%	25% of all resources	40%	60%	554
Next 20%	20% of all resources	60%	80%	334
Next 20%	15% of all resources	80%	95%	185
Least poor 20%	5% of all resources	100%	100%	74

Source: ECDoE, 2005

The ranking of schools in each of the Provinces has also been complicated by the discrepancy between a school's ranking on the "relative poverty of the community around the school" factor and its ranking on the "physical condition, facilities and crowding of the school" factor.

The "relative poverty of the community around the school" factor deals with the broad socio-economic conditions of the community around the school. This factor can also be interpreted as referring to communities served by the school, thus moving beyond the immediate geographical environment in which the school is situated. The "physical condition, facilities and crowding of the school" factor deals with general infrastructure needs at schools. The poor schools were allocated relatively low per learner amounts because of the weighting of school conditions in the provincial Resource allocation table. The North West DoE similarly to the EC has asked district officials to identify the affected schools and it plans to introduce broader indicators of conditions at school as from 2001.

Provinces have generally chosen two routes, namely a geographical definition of the school community and a definition that relies on the actual community served by a school, irrespective of its geographical location. The Northern Cape and Mpumalanga followed a process where learners are traced back to the actual community conditions in which they live. Funding therefore follows the learner and schools are not penalised because they are situated in a better socio-economic area. Gauteng Province argues that learners who move from disadvantaged schools to advantaged schools did so out of choice, and this will not necessarily mean that such schools will be positively ranked on the poverty criteria. It is only when learners from disadvantaged areas moved because there were no alternatives, that the Gauteng DoE will be willing to allow funding to follow learners (DoE Annual Report, 2003). It is thus only this percentage of learners in their newly placed schools that will gain the benefit of redress funding, and not the whole school as such. The purpose is to strengthen schools in disadvantaged areas and to begin to influence the migration of learners to more affluent schools. The intent in other provinces is similar to that of Gauteng, for instance, the development of rural schools is now seen as a priority in KwaZulu-Natal.

The task that remains for all PED's is to continue finding indicators that allow better and more sophisticated targeting of poor learners. Targeting of the poorest learners would be substantially enhanced if the proportion of non-personnel expenditure in provincial education budgets could be increased.

In the absence of an adequate re-distributive base, the targeting of available funding assumes even greater importance. Evidence from the DoE 2004 report shows that many Provinces

chose to prioritise the top re-distributive bracket of poor learners at the expense of other poor learners whose conditions were not noticeably different. The report recommended that the other PED's follow the example of Gauteng and the Northern Cape whose distribution mechanisms enabled them to bring more poor learners into the top re-distributive brackets of funding. This leads to a situation where the maximum allocations to the neediest are reduced, but the benefits of redress funding are likely to be spread more evenly for poor learners in general. Although such a scenario is not ideal, it prioritises the sustainability of redress funding, and drives home the point that an improvement of education quality must be applicable to the greatest majority of poor learners.

Schools for the transfer of money from Provincial Head Office are divided into two. Section 21 schools receive their transfers as cash payments, whereas non -section 21 schools' allocations are still managed by the Department. Section 21 schools are defined as public schools where the school governing body has been awarded a range of functions such as maintaining school property, purchasing textbooks and to directly pay for services rendered to the school as set out in section 21 of the SASA.

Governments across the world have used access to quality Learning and Teaching Support Material (LTSM) as one of the important instruments for promoting equity, redress and quality learning for all in the public education system (Fiske, 1996). Thus, improving the supply of textbooks can contribute positively to quality of education in the Eastern Cape.

2.2.1 PROVINCIAL FUNDING FOR EDUCATION

A reflection of the division of powers between the national and provincial governments can be found in the way that education is financed. The overwhelming proportion of income in the provincial budgets, on average over 95%, comes in the form of transfers from national government and a second portion, which is a smaller source of provincial revenue for education related special projects (Ajam, 2001). The provincial share from national fiscal is calculated on the basis of a formula developed by the National Treasury. The details of the formula are negotiated in the Budget Council that is

comprised of the Minister of Finance and the nine provincial MEC's for Finance and approved by the national Cabinet (Ajam, 2001). Once received, the grants may be allocated by the Provinces in whatever way they choose. Although the formula includes specific components to take into account the demands for education, health and welfare services, the Department of Finance emphasises that these components are neither indicative budgets nor conditional (Ajam, 2001). The national Minister of Education does not have any control over the amount allocated to Provincial departments of education as these allocations are made by provincial legislatures. It should be noted that the largest proportion of the provincial education budgets are for personnel expenditure and educators' salaries and are negotiated nationally in the Education Labour Relations Council with input from provincial education departments.

A second portion, which is a smaller source of provincial revenue, a little over 10% in 1998/1999 financial year for EC, comes in the form of conditional grants transferred from national government. These grants are allocated to provinces for specific purposes and may only be used for those purposes (for example, academic hospital services, school infrastructure and so on). Conditional grants are usually made to compensate for cross-border services or to ensure that national priorities are reflected in provincial budgets. Since these grants are usually made on the recommendation of the national Minister and administered through national departments, the Department of Education is in a position to influence at least some provincial education expenditure in this way. This influence is, however limited, as large proportions of the conditional grants are provided for improvements in public service salaries and conditions which are negotiated after the beginning of the financial year and thus cannot be used at the discretion of the national Department of Education (Ajam, 2001).

One of the results of the fairly extensive powers of the national Minister of Education in establishing policy, including for planning, financing and staffing, together with the more limited powers over provincial budgets, has been the provincial departments' often expressed feeling that they have been given 'unfunded mandates' by the national Department. Provinces represented by Education MECs and HODs have an opportunity to influence national policy and there is evidence that they are starting to be more

assertive when asked to consent to new policies which do not take account of their financial capacities to implement them (Ajam, 2001).

"Provinces with above average educator costs also tend to have more favourable learner:educator ratios, which also pushes up their education expenditures" (Edusource, 2001:10). Table 2 below shows the per-learner budgets for personnel and non-personnel costs as well as total costs of education in the provinces. Although per learner spending became more equitable over the course of the 1990's, in 2000/2001 the province with the lowest budgeted per capita expenditure (KwaZulu-Natal) still received 84% of the national average while the province with the highest per capita budget (Northern Cape) received 134% of the national average.

For non-personnel expenditure, which includes textbooks, stationery, other learning materials and infrastructure, the inequalities between provinces were even greater, with Mpumalanga getting 70% of the national average while Northern Cape got 213%. The highest budget allocation in the Northern Cape and Gauteng does not necessarily translate into highest number of learners with textbooks.

Table 2: Provincial Per Learner Budgets (in Rand) for Personnel and Non-Personnel Items, 2000/01 (amounts expressed as a percentage of the national average)

	Personnel		**Non-personnel**		**Total**	
	Rand	%	Rand	%	Rand	%
Eastern Cape	2870	92	304	78	3174	90
Free State	3399	109	539	138	3939	112
Gauteng	3711	119	645	165	4355	124
Kwa-Zulu-Natal	2650	85	293	75	2943	84
Mpumalanga	2852	91	272	70	3124	89
Northern Cape	3885	124	831	213	4717	134
Limpopo	3085	99	323	83	3408	97
North-West	3509	112	321	82	3830	109
Western Cape	3682	118	551	141	4233	121
Average	**3121**	**100**	**390**	**100**	**3511**	**100**

Source: Edusource Data News, No.33, June 2001

2.3 SCHOOL GOVERNANCE

Together with the constitutional allocation of powers to the Provinces, the other major education reform initiative in post-apartheid South Africa is reflected in the South African Schools Act (SASA) of 1996. The Act replaces the multiple school models of the various apartheid education departments with two legally recognised categories of schools – public schools and independent (private) schools. Its most important provision underlines the establishment at all public schools of governing bodies with considerable powers. These governing bodies must be composed of the school Principal and elected representatives of parents, teachers, non-teaching staff and (in secondary schools) learners. Governing bodies may also co-opt non-voting members. Parent representatives must make up the majority of voting members. Governing bodies of public schools are juristic persons, able to enter into binding contracts and to sue and be sued.

In order to deal with the heterogeneity of the school system, the Act makes it possible for the governing bodies of different public schools to have different powers and functions. A basic set of functions are stipulated for *all* public school governing bodies. They are required to:

(a) develop and adopt a constitution and mission statement for the school;
(b) to determine an admissions policy for the school, subject to restrictions;
(c) administer and control the school's property, buildings and grounds, and have the right to rent them out for fund-raising purposes;
(d) recommend to the provincial Department of Education the appointment of teaching and non-teaching staff; and
(e) develop a budget for the school, which could include schools fees, for approval at a meeting of the parents.

Once approved by the parent body, school fees become compulsory and all parents, unless specifically granted exemption, are obliged to pay them. Such exemptions are provided for by the *National Norms and Standards for School Funding* (DoE, 1998), which allows for parents who are less able to pay to be fully or partially exempted from school fees. Learners may not

be removed from a school or be denied access to the school if parents do not, subject to certain requirements, or cannot afford to pay fees. However, the school may sue the parents for fees owing. An amendment to the Act in 1997 allows all public schools to use funds that they have raised to employ teachers in addition to those allocated and paid for by the provincial departments of education.

Governing bodies may also apply to their provincial education department to be allocated additional functions. These could include (but are not restricted to) the right to:

- maintain and improve the school's property, buildings and grounds;
- determine extra-curricular activities;
- choose the subject options offered at the school, within the parameters of the provincial curriculum policy; and
- purchase textbooks and other materials and equipment.

Currently, these powers are exercised mainly in former white schools whose governing bodies usually include skilled professionals and managers (Sayed and Jansen, 2001). However, it is the aim of the government eventually to grant additional powers to all school governing bodies as they become willing and able to exercise them. In recognition of the fact that many school governing bodies may have difficulty fulfilling their basic functions or qualifying for additional functions due to the lack of experience or skills, the Act requires all provincial governments to provide training for governing bodies. While the powers of governing bodies are restricted in significant ways, the SASA gives them important powers that most schools in South Africa never had before.

The Schools Act, therefore, represents a major decentralization of power to the school level. This has undoubtedly had the effect of increasing the powers of school communities over their own school and of increasing democratic participation in schooling. However, it is doubtful whether the decision to control school funding by allowing public schools to charge fees has helped the poor. The initial decision by government to allow schools to charge fees was based on an argument put forward in the second White Paper on Education and Training (DoE, 1995b). The contention was that the government could not afford to fund the middle class

(mainly former white) schools at the same level as before. If the cut in funding at these schools caused the quality of schooling to fall if no other source of funding was available, then middle class parents would begin to remove their learners from the public school system and place them in independent schools. In time, this would deprive public schooling of its most influential advocates as business people, professionals, politicians, senior public servants and even teachers no longer depended on the public schools for the education of their own learners and grand learners. This would be to the detriment of the *entire* public school system, and it was felt that the only way to avoid it would be to allow parents to supplement state funding for their own schools.

The Schools Act provided for the poor by stating that the state 'must fund public schools from public revenue on an equitable basis in order to ensure the proper exercise of rights of learners to education *and the redress of past inequalities in education provision*', (emphasis added) in Section 34(1).

2.3.1 GOVERNANCE BETWEEN THE PROVINCE AND THE SCHOOL

All provincial departments, including the EC department of education, have head offices where their leadership and most senior officials are located (DoE, 2003). In addition, all Provinces have established lower level structures for purposes of administration and execution. These structures normally known as districts are not uniform in all Provinces, varying in both size and function. Some Provinces are divided into both regions and districts, and the districts are further divided into circuits in some Provinces (Ajam, 2001). None of these sub-provincial structures have powers vested in them by legislation. Their officials are directly responsible to the provincial department of education and not to any local political constituency that is, there is a de-concentration of powers from the head offices of provincial departments of education to the lower structures.

The ECDoE has 23 district offices that were established in 2001. These structures are an integral part of the provincial bureaucracy and have no direct responsibility to any elected political authority. South Africa has no tradition of municipal involvement in

education (except in the most peripheral ways: municipal buses are used by learners going to and from school; municipal libraries and sports fields that are used by learners out of school hours; etc.). There have also been no significant demands from municipal governments for a role for themselves in the public education system.

There are recently established District Education and Training Councils that exist in some Provinces, including Gauteng and Eastern Cape. These are stakeholder bodies, appointed according to criteria determined by the MEC for Education; they have only advisory powers and cannot make binding decisions. Patel (2001) suggested that the powers, functions and funding of the districts bodies should include the following:

- Norms and standards for funding of these districts should be determined (the funding could be based on a similar method as used in the school funding norms, targeting the poor);
- The District Governing Body (DGB) should be allowed to open a bank account, maintain a District Fund, and procure material, services and personnel;
- The district may also raise funds through donations, grants and fees [from the institutions in the district];
- If the fee levying is not practical, the possibility of property or other forms of taxes should be considered. The DGB will be responsible for governing and the district manager for the professional and administrative operations of the district; and
- The DGB will be a juristic person and should hold a position of trust.

However, as provincial governments continue to place greater emphasis on the importance of strengthening district administrations, there is a long term view of aligning the education system to the municipalities.

2.3.2 DECENTRALIZATION IN THE EASTERN CAPE EDUCATION SYSTEM

Decentralization can be a way of improving access to services, tailoring government actions to citizen's needs, and increasing the opportunities for state-society interactions. Sub-national governments, however, will only be effective when they have access to the

necessary human and financial resources and the devolved authority to undertake the services that have been conferred. Many philosophers and theorists have defined the concept of decentralization as detailed below.

(i) Decentralization is the transfer of authority and responsibility for public functions from a central government to subordinate governments. Governments are typically heterogeneous and complex entities that may consist of central, provincial, and local layers. Centralization and decentralization are modes of governance that is ways in which control is exercised and decision-making operates within the government (von Braun and Grote, 2000).

(ii) Decentralization is a process of re-assigning responsibility and corresponding decision-making authority for specific functions from higher to lower levels of government and organizational units (Rondinelli, 1981).

(iii) Education system decentralization is a political process because it involves substantial shifts or perception of shifts in power. Also, education is critical to national economic development, and school systems are vehicles for enhancing political influence and for carrying out the programs and objectives of those in power (Winkler, 1999)

(iv) Decentralization involves devolution of different decision-making powers and responsibilities to sub-units of the government. The following types of decentralization can be distinguished in evaluating impacts of decentralization on poverty (Litvack, 1999):

a. *political decentralization* gives local citizens and their representatives more power in any type of decision making, including setting standards and legal frameworks.
b. *administrative decentralization* redistributes authority, responsibility and resources among different levels of government. Suitable capacities and institutional strengths at all tiers are a precondition for the effectiveness of this.

c. *fiscal decentralization* entails the definition of authority over raising revenues or access to financial transfers and making decisions on current and investment expenditures.

(v) Smith (1985) defines decentralization as any political act in which a central government formally cedes powers to actors and institutions at lower levels in a political administrative and territorial hierarchy.

(vi) Mawhood (1983) describes decentralization as any act in which a central government formally cedes powers to actors and institutions at lower levels in a political-administrative and territorial hierarchy. Devolving powers to lower levels involves the creation of a realm of decision making in which a variety of lower-level actors can exercise some autonomy (Booth, 1995).

(vii) According to Falleti (2004), decentralization is contrary to the previous philosophies, in the sense it is not a once-off event but a process. This process is the set of "policy reforms" aimed at transferring responsibilities, resources, or authority from higher to lower levels of government. Decentralization does not include transfers of authority to non–state actors (as in the case of privatization reforms). The decentralization reforms could lead to either a policy ratchet effect (policy amendments) or power reproduction (momentum gain). She further indicates the following types of decentralization:

a. *Administrative decentralization* is a set of policies that transfer the administration and delivery of social services such as education, health, social welfare, or housing to sub-national governments.
b. *Fiscal decentralization* refers to the set of policies designed to increase the revenues or fiscal autonomy of sub-national governments. An increase of transfers from the central government, the creation of new sub-national taxes, and the delegation of tax authority that was previously national are all examples of fiscal decentralization.
c. *Political decentralization* is the constitutional amendments and electoral reforms designed to open new or activate existing but dormant or ineffective spaces for the representation of sub-national policies. Political decentralization policies are also designed to devolve electoral capacities to sub-national actors.

Falleti (2004) also highlights two fundamental forces that are at work, one is the process that is encouraged by the central government "president" or driven at sub-national level "mayors and governors". She mentions that central office would prefer transfer of power to be administrative (policy influence), followed by fiscal and political. The municipalities or regions would prefer political power (voters/elections) followed by fiscal and administrative.

The team that was deployed by the National Department of Public Service and Administration visited the EC in 1999 to assist the Department of Education in developing a strategic plan, a new organizational structure, a plan for improving service delivery and a human resource plan (PSAM, 2004). The team concluded that the hierarchical and centralized structure set up in 1997 that includes six regional offices and forty-one district offices was obsolete and nonfunctional and needed to be replaced. The new plan was to have a central office that focused more on policy development, planning and the formation and co-ordination of twenty-four new district offices that would be responsible for delivering education services including provisioning of textbooks. A model for measuring the divisions of functions and degree of decentralization in the supply of textbooks was developed by combining four theories:

(1) The OECD methodology for measuring the degree of education decentralization divides educational functions into four groups:
    (a) the organization of instruction
    (b) personnel management,
    (c) planning and structures, and
    (d) resources.
(2) Fiske (1996) indicates that decentralization can be justified by devolving structure or content.
(3) Falleti (2004) noted four ways to measure decentralization:
    (a) the sub-national share of expenditures (SSE),
    (b) policy–making authority (PMA),
    (c) the type of appointment of sub-national officials (SOA), and
    (d) the territorial representation of interests (TRI).

(4) Agrawal and Ribot (2000) suggest that three distinct dimensions underlie all acts of decentralization:

a. who are the actors,
b. type of powers – create new rules, make decisions, implement and ensure compliance and adjudicate disputes; and
c. accountability – upward and downward.

The four theories above have different strengths and can be applied in different research situations. For instance OECD is focused in education system decentralization, Fiske's strength is on school education decentralization, Falleti and Agrawal & Ribot concentrate on political government decentralisation. The theories and experiences have been combined to develop a model to assess the division of functions and decentralization system of EC education in the provisioning of textbooks and results will be discussed in Chapter 5 below.

2.4 FINANCIAL AND FISCAL COMMISSION LSM STUDY

The Financial and Fiscal Commission (FFC) was established to improve accountability of the departments of health, education and social services in distributing funds between levels of government from national, province and local. The FFC undertook an investigation in the 2003/4 financial year on the provision of learner support materials (LSM) to schools in the sampled provinces. The report highlights some problems that the education system faces. Three provincial departments of education were engaged in a self-administered questionnaire/survey that was circulated by e-mail for the FFC study. The report was based on a very small sample of schools (22) and three provinces were surveyed, Eastern Cape, Free State and Western Cape.

In its submission, the FFC commented on the financing of LSM. The comments were based on an initial study that indicated inadequate and erratic expenditure on LSM. Although the survey was based on a very small sample of schools, it did show that there were many problems associated with the provision of LSM and that these were more pronounced in townships and rural areas. A separate questionnaire was addressed to provincial education

departments in three Provinces for control purposes. The questions addressed to schools covered:

(a) the availability of textbooks and stationery;
(b) the supply of learner support material;
(c) the causes of textbook shortages;
(d) per learner allocations of textbooks;
(e) the lifespan of textbooks;
(f) the buying cycle of textbooks;
(g) the control of learner support materials in schools; and
(h) school funding choices.

2.4.1 AVAILABILITY OF TEXTBOOKS IN SCHOOLS

The survey results show that the number of textbooks available in schools and the basic number of textbooks required per grade varies according to the grades. The costs of textbooks differs significantly between grades. The Grade 10 to12 textbooks cost is higher (R100 – R150) than that of primary grades. In primary grades, generally, learners do return textbooks while in secondary grades most learners do not. The survey showed that in primary grades (grade 1 to 3) the number of required textbooks is adequately provided, although more is required for outcomes-based education (OBE). OBE requires textbooks to be written in experimental mode rather than experiential mode. In grades 4 to 6, there is a need for a variety of textbooks so that learners can be exposed to alternative views.

For grades 7 to 9, there has always been a shortage although the situation is improving as more textbooks are printed and distributed. Grade 8 is the first grade of secondary school and the results of the survey show that there are few secondary schools in rural areas where learners can be admitted after finishing primary school. This results in overcrowding in few schools and in abnormal learner admission patterns. Thus, requirement projections on the number of learners and textbook and stationery quantities are very difficult to make.

For grades 10 to 12, there is a general shortage of textbooks, particularly in township and rural schools. In grade 11, this is caused by the abnormal repetition rates. Some of the reasons for the failure rate in grade 11 include the pressure on schools to produce high pass rates in grade 12. This results in the "gate keeping" of learners, learners deciding not to write exams, and high drop-out rates. In grade 12, the reasons for learners opting to repeat grade 12 is to improve their chances of entering tertiary institutions. The survey results suggest a better scenario for exercise books than for textbooks. For grades 1 to 3, the survey shows that stationery is adequately provided, while in grades 4 to 9, more exercise books are generally required. This is because the curriculum has changed to learning areas requiring more work books. In the provision of 'counter books', there are shortages in secondary schools (10-12). More 'counter books' are used for projects and class work than the exercise books supplied.

A factor that complicates the provision of textbooks compared to stationery is that it involves consideration of the curriculum, language(s) used by schools, subjects, approved bookseller and suppliers. Moreover, the cycle for the supply of textbooks is three to five years with top-ups and supplements yearly.

2.4.2 PER LEARNER ALLOCATION OF TEXTBOOKS AT SCHOOL LEVEL

In the schools that were surveyed, the results showed that differences exist in the resource allocation per learner. In allocating the required LSM, schools give preference to secondary grades. In secondary grades, it is mostly grade 12 learners that have the required textbooks and stationery. In some cases, the required number of textbooks and stationery per learner is not met at all. From grades 8 to 11, schools sometimes require parents to buy the necessary stationery. From survey, the minimum number of textbooks required for the latter grades is almost always not met. Preference is given to grade 12 because of the pressure on schools to produce high pass rates for matriculants at end of the year. In KwaZulu-Natal (though not sampled), the allocation on average is as little as R35 per learner per annum, whereas the legislation stipulates a minimum of R100.

2.4.3 CAUSES OF SHORTAGES IN LEARNER SUPPORT MATERIAL

According to the survey results, there is no single explanation for the acute shortage of textbooks in schools as the situation is not identical in all schools. Clear differences exist among schools within an area as well as between areas. Some schools expressed concerns that funding for LSM is not clearly defined in budgets. A lump sum amount for LSM is provided without guidelines on how it should be allocated between textbooks and stationery.

The migration of learners is another factor contributing to the shortages of textbooks in schools. Learners move either from one school to a nearby school or from rural to urban schools within and among Provinces. In the former case, one main reason for migration is the lack of proper infrastructure in the schools (Fiske and Ladd, 2004). An example is where all learners moved to a nearby school because of the dilapidated conditions of the classrooms. The FFC study showed that migration from rural to urban schools is due to the perception that the urban schools are better resourced. This migration puts pressure on schools to admit more learners. As one of the consequence, repetition rates are higher in secondary schools than they are in primary schools. This results in an incomplete net flow ratio of 12 years of schooling, as learners do not progress steadily from one grade to the next. The consequence is that textbooks and stationery do not circulate as intended. The Department of Education's "Back to School Campaign" has been a success in terms of improving enrolments and reduced dropout rates. This in turn has led to an increased demand for textbooks in schools.

The current requisition system requires schools to fill in orders through the requisition forms and then these are sent to the provincial education departments. The provincial education departments verify the information given and capture this onto a database. Schools see this process as cumbersome because of the number of schools within a Province. For example, schools indicated that, although they did follow the process of ordering textbooks, more often than not they did not get the ordered materials. The provincial departments repeatedly asked for the requisition forms to be resubmitted/resent claiming they had not been received. Furthermore, it is believed that

the drawn-out provincial tender board procedures and processes contribute to the supply delays and the shortages of textbooks in schools. Another cause for concern is that in some cases, once books are delivered to schools, storage facilities for the books are either inadequate or non-existent. For example, the FFC survey showed that in some schools a principal's offices were used as the storeroom for textbooks. Lean thinking involves delivering what the customer (schools) want, when they want it (just-in-time) at the quality and quantity they want. Thus, just-in-time delivery of books can assist when there is lack of storerooms for textbooks.

Another problem associated with the shortage of LSM is the need to provide mother tongue textbooks. Often, schools receive textbooks in the wrong mother tongue. This was particularly true in the Eastern Cape and the Free State in bilingual schools that have both English and Afrikaans as the media of instruction. In certain instances, the textbooks had not even been printed. In some schools, textbook management systems such as issue and asset registers are inadequate or non-existent.

2.4.4 THE BUYING CYCLE OF TEXTBOOKS

The survey results show that schools do not buy textbooks every year. Requisitions are made for supplementing existing stocks, for replacement of damaged or lost books, or supplementary orders to meet higher enrolment needs. Due to the curriculum changes from Curriculum 2005 to Outcomes Based Education (OBE) to NCS, schools have had to order new textbooks to meet the requirements of the new curriculum, although in most cases they receive the ordered materials. In some cases, it was reported that textbooks ordered specifically for the new curriculum were not received.

2.4.5 THE LIFESPAN OF TEXTBOOKS

The survey results show that textbooks typically last for five to seven years in secondary grades and three to five years in primary grades. However, due to losses and poor registers of the textbooks, parents are encouraged to replace them. Sometimes schools

keep a child's progress report until the book is replaced. This practiced is prohibited by the DoE in the Schools Act as it discourages attendance of schools by learners. For poor communities, even though parents might have aspirations to replace textbooks, sometimes circumstances are such that there are no means to purchase a R120 book. This has led to absenteeism because of intimidation from teachers even though this is prohibited and discouraged by the DoE (Fiske and Ladd, 2004).

In some cases, the replacement is charged in the school fees and there is both research and non-research evidence emerging suggesting that school fees are a serious burden on the poor. It is also evident that some schools exclude learners whose parents cannot or do not pay fees, or intimidate learners whose fees have not been paid sometimes to the point that learners absent themselves from school in order to avoid being questioned as to why their fees have not been paid. The then Minister of Education, Professor Kader Asmal, summarised the situation in a speech in Parliament when introducing the debate on the Education Budget (6 June 2002): "In all our laws, we have protected the rights of the poor to access general education. Regrettably, despite the protection of the law, we know that some schools are turning away learners because their parents are unable to pay school fees or provide school uniforms. School authorities are duty bound to protect the best interests of the child; by denying them access to schools, they deny them hope".

2.4.6 CONTROL OF TEXTBOOKS IN SCHOOLS

The control of LSM depends on the location of the school and the relevant school management systems. Some schools have effective monitoring systems. A learner is given a textbook and this is recorded in the issue register form and the form is signed by both the parent and the learner. If a learner fails to return the textbook, the parent is held liable for its replacement. In these schools, the survey indicates that the return of textbooks is generally more regular. However, in some schools where there is no monitoring of distributed and lost textbooks, the textbook shortage is significantly aggravated. In some former model C schools, a particular teacher is charged with responsibility for ensuring the provision, maintenance, storage and replacement of textbooks.

2.4.7 CHOICES FOR SCHOOL FUNDING

Schools have a choice in determining their levels of school fees. The survey results show that schools charge different levels of school fees. The amount varies by grade and the location of the school. Generally, the school fees are lower in primary grades than secondary grades and they are higher in urban schools than in semi-urban and rural schools. Only 50% of rural learners make school fees payment which is far less compared to semi-urban and urban areas. This may suggest that schools in urban areas are better resourced. However, some schools overcome deficits in textbooks through school fees; this is a popular practice in the former White schools. In poor communities, even if the shortage has been recognized and communicated, parents sometimes cannot afford to pay R120 (DoE, 1998).

2.5 KWAZULU NATAL – CASE STUDY

Many learners in KwaZulu-Natal (KZN) province have had an extra hurdle in the education race, the hurdle of late textbook and stationery delivery and sometimes no delivery at all. This obstacle that has been inherited from the past would have had a negative impact on the quality of learner performance and achievement of our learners (Fiske and Ladd, 2004). The KZN education department decided that research should be undertaken to reveal the shortcomings and recommend a better system to ensure that all learners are equally treated and getting KZN education to achieve the effective and successful delivery of the LSM for 2006 academic year. The team, led by Education Policy and Planning deputy director-general Themba Ndhlovu conducted extensive research and made a number of observations summarized below.

The old system used by the Department had no control over the purchase and distribution of the LSM once it had handed over the requisitions to the suppliers. Some of the suppliers did not have storage capacity or vehicles to deliver the materials. Others did not plan well, often arriving at school after hours and "dumping" books that were not ordered or making short deliveries on the order. As a result, the department could not tell at any given time with any certainty where the process was and was thus at the mercy of the suppliers.

In order for the Department to meet its obligations, there was a need to introduce a procurement system that encompassed the principles of a good public procurement system, such as best value for money, efficiency, fairness and transparency. The PFMA notes that good procurement practices hold practitioners responsible for enforcing and obeying the rules. It sanctions them if appropriate, for neglecting or bending the rules, regulations and guidelines.

After careful comparison of the best practices in other provincial education departments, it was decided to outsource the service to two managing agents that would enable the tracking and tracing of deliveries.

As from 2005, two companies EduSolutions and Indiza Motswedi were responsible for the procurement and delivery of textbooks and stationery in KZN under the close supervision of the Education Department. Their functions were largely administrative and logistical, mainly ordering, sorting, packaging and storing of books and stationery, capturing of requisitions, checking and correcting placements of orders and constantly reporting on the delivery system. Distribution was to be undertaken by local SMMEs.

The new integrated system allows the Department to manage orders and deliveries and for the first time the Department knows exactly how many books a school has ordered and received, which will assist officials to check orders against the enrolment of learners.

The provincial department buys textbooks that should last three to four years but because of poor retrieval, schools lose between 10% and 90% books per annum. The result is unnecessary budget increases and the inability of the system to eradicate backlogs in the supply of quality LSM to all. By having better information on the use of LSM at school level, the Department will have more power to increase the retrieval rate of books.

The two companies buy books and stationery directly from publishers and manufacturers on behalf of the Department. This also ensures that all discounts obtained from the publishers will flow back into the LSM budget, which in turn will enable the Department to buy more books for redress.

The EduSolutions and Indiza warehouses were visited to assess the readiness of deliveries when the schools re-opened on 18 January 2006. Close to 1500 of the 6000 schools received their textbooks before schools closed on 2 December 2005. The lack of storage facilities at the remainder of the schools prevented more deliveries in 2005. In the past, the majority of

schools were built without storerooms and the Department is reviewing the design of schools to take into consideration storage facilities.

According to the MEC Education January 2008 report, of the 3 211 non-section 21 schools, 95,45% already received 97,95% of their textbooks in December 2007, before schools closed. District managers are currently investigating why 32 principals did not order any books despite several reminders. If they found that there is an under supply of textbooks in the schools, disciplinary action will be taken against the principals.

This is an improvement compared to the far cry from the sad picture in January 2005 when an audit found that only 149 (4,6%) of non-section 21 schools had received their textbooks by the time schools re-opened. The steady improvement of textbook deliveries before the first day of school has moved from 4,6% delivery in the 2005; 40% in 2006; 80% in 2007 to 95% in 2008 (academic year).

In addition there has been an increase in the allocation of money to buy books and stationery. In the 2003/04 financial year only R379 million was allocated to buy LSM. This has been steadily increased to R870 million in the 2006/07 financial year and R828 million in the 2007/08 financial year.

KwaZulu Natal is the best local example with an education system that previously suffered the same as Eastern Cape but steadily shown signs of improvement. The international best practice cases are discussed in section 2.6 below which can be emulated to foster prudent management of supply and distribution of textbooks to schools.

2.6 INTERNATIONAL CASE STUDIES: CONTROL AND SUPPLY OF TEXTBOOKS

The following analysis by Le Métais (1996) shows that most sampled countries in the international review of curriculum and assessment frameworks operate free market systems of textbook production and supply, although there are some exceptions. Prescribed textbooks are a means of controlling curriculum and structure, 'allowing teachers to concentrate on method'.

Textbooks are not intended to replace official guidelines on teaching style but do have a considerable influence on the breakdown of subject matter and course sequence. Commercial considerations may have an unintended impact, e.g. the large numbers of students in California, Florida and Texas mean that these states, through their requirements, exercise a considerable influence on the content of textbooks in the US as a whole.

a) Production

Textbooks are produced by the State in Japan, Korea, New Zealand (some), and Singapore, by the *Cantons* in Switzerland, or by commercial publishers who have to satisfy State/local guidelines regarding:

- content (Ministry in France, *Länder* in Germany, Hungary, Japan, Singapore, *cantons* in Switzerland, and 21 USA states)
- format (France, Germany)
- quality (Germany)
- cost (Germany, Italy).

b) **Selection -** Books to be used in individual schools are:

- prescribed by local boards (Japan).
- chosen from official lists by (teams of) teachers in France, Germany, Hungary, Singapore and Switzerland. In some areas of Germany, the inspectorate may have to grant permission and/or representatives of parents and students may be consulted.
- chosen by teachers without restrictions in Italy, the Netherlands, New Zealand, Sweden and in post-compulsory schools in Switzerland.

c) **Supply -** Textbooks are:

- provided free of charge, on loan, by central or local authorities in France, Germany, the Netherlands, New Zealand, Sweden and Switzerland. All Japanese students receive a complete set of new books annually, to keep.
- Purchased by parents for students in all phases of education in Italy and Singapore (grants for needy students) and for post-compulsory students only in France, Japan, and Switzerland.
- To contain costs, the frequency of change is controlled in Italy (unspecified intervals), France and Japan (at least four years between changes), and in Kentucky USA (six-year cycle).

AUSTRALIA: Parents are responsible for buying stationery and textbooks prescribed by the school. Some schools incorporate the stationery and book charge in their annual levies while others keep this charge separate. Parents have the right to expect that if the charge is incorporated into the levies it will be clear which amount is for books and stationery.

FRANCE: Under French law, the textbooks produced by private or public educational publishers for teaching at the various levels of school education are based on the curricula and official recommendations of the (national) Ministry of Education. Once publishing houses have received the Ministry's official recommendations/guidelines, they have a minimum 14 month period in which to produce the textbook(s). Textbooks must be designed to conform with a curriculum previously agreed with the Ministry and the cover or title page must state which class and level of teaching the textbook is intended for. Textbook publishers also produce teachers' manuals to accompany the relevant student text- and work-books. These are written under the responsibility of the author and do not replace official texts providing guidelines on teaching methods and the curriculum. Textbooks intended for use in school must be approved by the national Minister of Education. There is also a National Commission which approves/monitors *all* publications intended for a young audience. That is to say it monitors (in terms of propriety, etc.) all books, not just school textbooks, which are destined for a young (learners, adolescent) audience.

Who chooses which books are used in each class?

There are no prescribed teaching methods or materials for primary or secondary education. Teachers are free to choose their teaching methods and materials. Teachers in each school usually agree on the particular materials they wish to use from the (approved - see above) range available from private educational publishers. Teaching materials are usually published for use nationwide. Local or regional associations and documentation centres in the *régions* or *départements* sometimes produce teaching materials as a local supplement to those published for national use.

Teachers are expected to develop clear criteria for the selection of school textbooks and the latter must conform with the curricula in force/recommended Ministry of Education curricula. One of the criteria for selection is expected to be that the textbook stands alone, that is, it does not depend on the provision of support documents. Groups of teachers in each subject meet under the chairmanship of the school principal (or equivalent) to discuss their proposed criteria for the selection of textbooks and their proposed list of textbooks. These criteria and the list are then put

before the school's *Conseil d'administration* (board of governors), which includes some parent members. This *Conseil* makes its opinion known, but the final decision is that of the 'teaching council' (the council of all relevant subject teachers). Their decision must be made public no later than the June preceding the start of the school year for which any decision will be relevant. Textbooks must leave teachers free to choose their own teaching methods, which can be suitably adapted in accordance with the needs of different groups of students. Use of textbooks from the school's recommended list does not exclude teachers from using any other method which he/she deems fit.

Head teachers use their own commercial judgment to select the publisher/bookseller from whom to acquire the approved textbooks. It is generally expected that a school's list of recommended textbooks should not be changed too often, e.g., the same textbooks should be used for four consecutive years in lower secondary education. Any change of textbook or purchase of supplementary textbooks during the course of the school year is prohibited. Teachers are also expected to use the same textbooks for classes of the same level.

Are textbooks provided by the State, the school or do parents buy them?

A decree issued in 1985 affirms that the State funds expenditure relating to the provision of textbooks in *collèges* (lower secondary schools, age 11+ to 15+) and special schools and teaching materials for collective use in vocational *lycées (upper secondary schools, age 16-19)*.

Generally, textbooks are loaned free of charge to students in compulsory education (primary school since 1890 and public and private sector *collèges* since 1977). Parents are expected to contribute towards the cost of damaged or lost textbooks provided by the State on a sliding scale: the full cost of brand new textbooks; 50 % of the original cost of a textbook which is being used for the second year; 30 % of a book in its third year of use; 20 per cent in the fourth year etc. Such income must be used by schools to repair the damaged textbooks or to replace lost ones.

In primary education, the *communes* (via the municipal budget) are responsible for ensuring that there are adequate funds in their budget to pay for textbooks. In about 10% of cases, however, parents pay, e.g. in small communes in which budgets are restricted. Head teachers/principals receive a specific budgetary credit per teacher and per subject to cover the cost of teachers' textbook issued (not loaned) to teachers on request. Funds not required for textbooks can be used for other educational materials, audio-visual equipment/documents etc., especially those which are produced by the *Centre national de documentation pédagogique* (*CNDP*) (National Centre for Educational Documents/Information).

Small, individual items of equipment required, e.g. exercise books, some books, items of stationery etc. are provided by a student's family. Families are consulted when lists of such materials are compiled for the next/following school year.

As the final two years of *lycées* (the *première* and *terminale* classes, students aged 16-18) are not compulsory, families pay for supplies and textbooks required for this phase. They either acquire these individually (book shops can offer a 5% reduction on textbooks sold to individuals) or through an association (e.g. a parent-teacher association), in which case reductions may be as much as 20-45 per cent. There is no maximum price limit for textbooks VAT of 5.5 per cent is charged on school textbooks.

Nationally devised testing material is provided for teachers in primary and lower secondary schools through a computerised data bank. Teachers are invited to make use of this freely and when they so wish to assess the progress of their charges. Teachers are also provided with such testing/assessment material in hard copy, as computerisation has only just been introduced (1996).

GERMANY: The School Book Committee in the Ministry of Education and Cultural Affairs in each of the *Länder* formally controls the list of approved textbooks in each subject area for use in the classroom. Books produced by commercial publishers are approved:

- if they are in line with the general principles of the Constitution and the educational objectives set out in Education Acts;
- if they are compatible with the syllabi and with educational research findings for the various types of schools;
- if the quality of the binding is appropriate and the price justifiable.

External criteria such as the number of pages are taken into account for approval purposes insofar as the size and format should be consistent with the contents which are laid down in the syllabuses, the chosen approach to the subject and the age of the students. Textbooks for religious education also require the agreement of the church authorities.

In most types of school, textbooks are still the decisive instruments in planning and the textbooks in use frequently appear to have a greater influence than the appropriate curricula on the standards and breakdown of subject matter and on the sequence planning of course content.

Who chooses which books are used in each class?

Each Ministry of Education and Cultural Affairs regularly publishes a list of the textbooks approved in the *Land* concerned. (These lists also contain some of the legal and administrative

provisions governing the free supply of teaching materials and the approval of textbooks, along with indications of the criteria to be used by those who are appointed by the Ministry of Education to assess textbooks.)

The school staff select books from a wide range of approved titles for use in their schools. This selection is generally made at meetings of teachers of the same subject or of the whole staff, although in some cases the approval of the schools' inspectorate is required; some *Länder* also have rules for consulting parents' and students' representatives.

Who is responsible for producing textbooks?

Textbooks are generally produced by specialist commercial publishers. Directives and curricula are important reference points for textbooks, which must be based on current directives and curriculum norms.

Are textbooks provided by the State, the school or do parents buy them?

To enable students, regardless of their income and social circumstances, to have access to all the teaching materials used in schools, teaching materials, and textbooks in particular, are provided free of charge in all *Länder*. The costs are borne either by the bodies (e.g. local authorities) responsible for setting up and running the schools, or by the *Land* authorities. Generally speaking, students attending state schools receive textbooks and certain other teaching materials (e.g. pocket calculators) free on loan, whereas expendable items (stationery, drawing instruments, materials for needlework and handicrafts) must be provided by parents and students. However, the rules vary from one *Land* to another. Whether learners in private schools are supplied with free teaching materials also depends on the *Land* concerned. In some *Länder* students/parents are required to contribute to the total cost of teaching materials by paying for certain materials themselves. Some *Länder* do not operate a loan system but provide grants to purchase materials; these grants may depend on parents' income or the type of school attended. The prices of textbooks are checked by the State to see whether they are reasonable. If a price is raised, approval of the textbook concerned may be withdrawn. In addition, competition between textbook publishers helps to ensure that prices remain reasonably low.

HUNGARY: The obligatory character of the National Core Curriculum means that in local curricular variations, teaching subjects and school textbooks:

- the principles of the National Core Curriculum are to be honoured.

- the areas and topics of the different cultural domains must be included.
- teaching materials and activities which contribute to meeting the objectives of general and detailed development should have priority.
- teaching materials and activities which contribute to meeting the objective that every student must be given the chance to fulfill at least the minimum competencies, should have priority.
- teachers select materials which are consistent with the National Core Curriculum.

ITALY: The government annually takes steps to reduce the financial burden on families by issuing a circular:

- recommending that, given the same educational value, less expensive books should be chosen
- forbidding any change in textbooks during the course for which they were adopted
- allowing students to use earlier editions of dictionaries, atlases and textbooks.

JAPAN: Schools may only use textbooks approved or compiled by the Ministry of Education, Science and Culture (*Monbusho*). The contents of the Course of Study (prescribed by the Ministry of Education) are faithfully reflected in the textbooks, teachers' manuals and programmes of work in each school.

Commercial publishers must secure authorisation of textbooks by the Minister of Education, who calls on the advice of the Textbook Authorisation Council and others.

Textbooks are subject to minor revisions every four years and to major revisions with the inception of new Courses of Study; and are provided in every subject except physical education. The prescribed curriculum and the structure provided by the textbooks allow teachers to concentrate their planning on pedagogy rather than on the design of the curriculum or the detailed planning of what activities or content to provide.

Are textbooks provided by the State, the school or do parents buy them?

Ministry approved textbooks are provided free (by central government) in all compulsory schools (whether publicly or privately funded). All learners in compulsory education are given (by central government) a complete set of new textbooks at the beginning of each school year, no matter whether they are being educated in Japan or in some other country. These books are the students' own property. Although some supplementary materials are used, the textbooks (provided in graded series) determine in very large measure the curriculum as experienced by the students.

Students are taken systematically through the text until its completion at the end of the year/grade. Postcompulsory, upper secondary school students buy their own textbooks.

Who is responsible for producing textbooks?

Textbooks are of two types. The first type are privately published and subject to Ministry of Education approval. Almost all schools use them and there are about 602 titles in all. Textbooks of the other types are written by the Ministry and used for some high school vocational courses for which there is little demand and in special education institutions. There are only about 40 of these.

Who chooses which books are used in each class?

Textbooks must be selected from those having Ministry authorisation. Selection is at the discretion of the appropriate board of education in the case of public schools or, in the case of national and private schools, of the principal. Textbooks to be used in public schools are adopted by local boards of education every three years.

With reference to textbook use in Japan, Harold Stevenson, a developmental psychologist at the University of Michigan who has conducted cross-cultural studies of education for three decades, staunchly affirms that the Japanese are not mechanical rote learners. He believes that an analysis of textbooks shows that they are designed to elicit active thinking in Japan. The books often require students to integrate information from old lessons with material from their current ones and to use their imaginations. The textbooks, he says, do not present a group of problems with answers, as do American textbooks. Instead, students get a few variations of a problem that they have studied.

They also get very difficult examples, which no one is expected to work correctly. Stevenson also states that Japanese teachers, like the textbooks, give students the basic building blocks of learning. They then try to elicit a change in thinking encouraging their students to solve a new problem with old tools. Teachers use a multitude of approaches. In the earliest years, for example, students carry a maths box. This is essentially a games box that includes colourful puzzles and tricks that explain maths and are explained by maths. They use them frequently and, when learners make mistakes at solving maths problems, the teacher asks them to explain their thinking at the board. Educators assume that most of the errors that are made will be common ones and that seeing the problems incorrectly worked and then corrected will be valuable to everyone in class. Teachers use the correction process gently, as part of the instructional method, and have a

different attitude to errors. In the primary school years, there is little grading and students almost never repeat a year.

KOREA: The Ministry of Education compiles and authorises textbooks. In accordance with Article 155 of the Education Law, which guarantees equal opportunity in education and defines the curricula for different schools (to ensure quality of education), school curricula are the criteria for educational programmes and textbook development.

In addition to textbooks as curriculum materials, the Educational Broadcasting System (EBS) was opened in 1990 in order to 'support school education and expand the opportunity for education'. EBS currently has one TV and one FM radio channel and a staff of 492. The Ministry of Education is responsible for policy-making, programme organisation and administrative and financial support, whilst EBS take charge of actual education broadcasting (planning, organisation, production and delivery) and the Korean Broadcasting System is responsible for transmission. The Ministry of Education subsidises the EBS to around 60 per cent of its budget and suggests the basic format of all programmes.

Educational broadcasting programmes (TV) are on air for seven hours and 40 minutes every day (17 hours on Sundays) and for 20 hours every day on radio. In addition to school education programmes there are also correspondence/open university programmes and social education programmes for learners, youth, parents and the public.

The national Ministry of Education expects the Municipal and Provincial Education Authorities (MPEA) to make every effort to develop and disseminate various teaching-learning materials other than textbooks. All schools, for example, are encouraged to utilise multimedia programmes and materials, such as radio/television programmes, audio-visual materials, computers etc. in combination with textbooks.

THE NETHERLANDS: Schools are free to determine curriculum content and to choose appropriate teaching methods and materials. Textbooks are produced by commercial publishers. Teachers choose textbooks for their classes. Textbooks are supplied by the school.

NEW ZEALAND: One of the distinctive features of the New Zealand education system is the quality of curriculum resource materials developed by School Publications, now known as Learning Media (currently an arm of the Ministry of Education, though soon to be established as an independent Crown Agency).

Learning Media staff are responsible for the editing and publication of the national curriculum statements and associated curriculum resource materials. Learning Media's products are distributed free to schools, although additional copies can be purchased if required or by members of the public.

Production deadlines are closely matched with the development of the new curriculum materials and regular meetings of the Ministry's Policy, Curriculum Functions and Learning Media staff take place to coordinate the development and production of curriculum support materials.

Textbooks do not require state approval because the New Zealand approach is not that of a textbook based curriculum. However, some curriculum-related resources are developed with government funding and are published by Learning Media or the New Zealand Council for Educational Research. In addition, curriculum-related resources are published in the private sector. The Ministry of Education runs an on-line telecommunications network with links to many schools. Curriculum related materials from state and commercial sources are available in a range of databases via this medium.

The Ministry of Education does fund the writing and production of a limited range of curriculum related resources. Writers come from many backgrounds. Learning Media produces most of these on a contract basis. Early childhood and school teachers and heads of departments select the books to be used in schools. If schools decide to use set texts, they may be provided by the school from their operational budget. Students may have other books recommended to them, in which case parents would buy them.

SINGAPORE: Textbooks produced by private publishers have to be reviewed and approved by the Ministry of Education before they can be included in the approved textbook list.

Textbooks are produced by private publishers, as well as the Curriculum Development Institute of Singapore (CDIS) which is a division of the Ministry of Education. Teachers and heads of departments in schools select textbooks based on the (Ministry of Education) approved list.

Parents normally buy textbooks, but needy students can apply for free textbooks.

SWEDEN: Textbooks are very often published by commercial firms. Teachers have the right to use or not to use a textbook in the subject they are teaching. Teachers are also free to choose whatever textbooks they need. Textbooks are provided by the school at both compulsory school and upper secondary school level.

SWITZERLAND: In principle, the *cantons* prescribe textbooks, but the schools and teaching staff do have a certain freedom of choice in the matter. The choice of teaching material is left to each school. There is consequently no national body which regulates the material used for teaching; for reasons of language, the choice of material, at least in some subjects, is under strong influence from abroad.

Cantons are responsible for the *gymnasium* curriculum. This means that compulsory standard Swiss textbooks are non-existent. In this free market situation only a few textbooks written by teachers have acquired reference-work status. It is only at upper secondary level that parents are expected to pay for text-books.

USA: Textbooks are produced by private companies, with about ten such corporations dominating the industry. Textbook selection is a local decision. However, 21 of the 50 US states (mostly in the South) recommend textbooks at state level after some process of review against state curriculum guidelines. This is similar to South Africa. In some cases, state education funds may only be used for the purchase of approved books. Because so many students are located in Florida, Texas, and California the curriculum and textbook guidelines of these states exert a strong influence on the content of textbooks in the United States.

Kentucky

Kentucky adopts textbooks on a six-year schedule, grouping purchases so that as nearly as possible, the same amount of money is expended each year on textbooks. A review team, selected each year, designs an evaluation instrument for reviewing bids, evaluates bids from publishers, and recommends items for adoption to the State Textbook Commission. The Commission determines listings for the State Multiple List, which is then sent to all local districts. Districts have an opportunity to review items on the State Multiple list, request samples, talk with vendor representatives, and decide which they will use locally.

Maryland

Maryland does not use a state adoption process. Each district makes its own decisions about textbooks and other curricular materials.

Table 3 below is a summary of Le Métais (1996) study regarding the control and supply of school textbooks.

	Eng	Aust	France	Germ	Hung	Italy	Japan	Korea	Neth	NZ	Sing	Sweden	Switz	USA
State prescribes	-	-	-	-	-	-	-	YES	-	-	-	-	-	-
Teachers choose from State-approved lists	-	-	-	YES	-	-	YES	-	-	YES[1]	YES	-	YES[2]	-
Teachers choose freely	YES	YES	YES	YES[3]	YES	YES	-	-	YES	YES	YES	YES	-	YES
Provider of books	School	Parents	School	School	?	Parents	School	?	School	School	Parents[4]	School	School	varies
Means tested subsidy											YES			
	Eng	Aust	France	Germ	Hung	Italy	Japan	Korea	Neth	NZ	Sing	Sweden	Switz	USA

Key: England, Australia, France, Germany, Hungary, Italy, Japan , Korea, Netherlands, New Zealand, Singapore, Sweden, Switzerland, USA.

Table 3: Shows global trend of control and supply of school textbooks

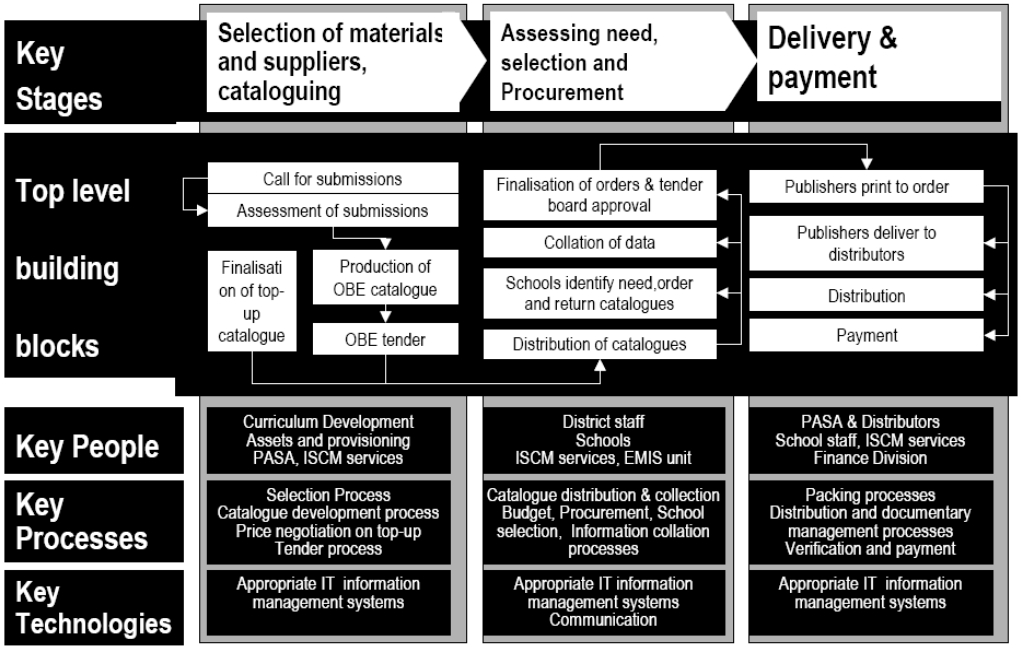
2.7 EASTERN CAPE SUPPLY OF TEXTBOOKS

The provisioning of LSM to schools in the Eastern Cape Province has improved radically since the mid-1990s (LSM Review Report, 2003). In the period 1995 to 2000, the system was plagued by problems in the requisitioning, procurement, delivery of and payment for LSM. In the late 1990's, some materials had not reached schools by the third and fourth month of the academic year. However, by the start of the 2003 academic year, most of the LSM replacement orders had been delivered, largely due to the outsourcing of information management in the requisitioning and procurement phases in 2002 and a re-ordering of supply chain processes on the delivery and payment end, a year earlier.

For the 2004 financial year, the catalogues for new materials were only completed late in the year. The services of a private consortium, PriceWaterhouse Coopers/East London Computer Bureau (PWC/ELCB) were again sourced under great pressure to manage the requisitioning and procurement process. The agreement with the Publishers' Association of South Africa (PASA), whereby they organised the delivery of text books to schools in return for the Eastern Cape Department of Education (ECDoE) forfeiting 15% of its standard 30% discount, had reached its final year with no alternative in place.

In response to similar pressures in 2002, the ECDoE commissioned a review of the LSM supply chain with the overarching objective of making a positive impact on the effectiveness and efficiency of LSM provisioning. The review was structured with an initial investigative phase to allow the ECDoE to formulate the required policies and asset management policies, to get the right materials at least cost in the right place at the right time. The review took place between February and October 2003, and was focused on making proposals to place the medium to long-term management of LSM on a stable, efficient and cost-effective footing. The study identified the key stages in the LSM supply chain.

Figure 1: Key stages, process and people in the ECDoE Textbooks supply chain



Source: ECDoE, 2003

The supply chain can be broken down into 3 main phases: evaluation and selection; ordering and procurement; delivery and payment (LSM Review Report, 2003). The diagram above illustrates the supply chain, while the subsequent paragraphs briefly discuss each, and a set of cross-cutting issues.

2.7.1 EVALUATION AND SELECTION

The Eastern Cape LSM system works on an approval system for published materials; schools may only order from an approved list of materials. The selection of materials from the list takes place when the ECDoE as a policy decision, decides to replace a grade or subject area across the Province. This usually results from National Department of Education (NDoE) curriculum changes. The book selection process takes at least 18 months prior to target delivery date, compared to 14 months in France. In 2004 during the introduction of new National Curriculum Statement (NCS) curriculum, the

Department selection started in November 2003 and was only completed in early May 2005, putting pressure on the downstream supply chain.

The evaluation is an open system with evaluators often poorly equipped to make decisions and wary of turning down books, lest they have to defend their choices to publishers in an appeals process. The usefulness of a catalogue as a selection tool is also in question because there is little to guide selectors who make the final choice as to the benefits and drawbacks of different materials. The choice may be within the list but it may not be the best for a school in terms of content and being friendly for a classroom environment. This may present a significant weakness in the system.

On-Time-Delivery (ODT) should be measured by the evaluators as to ascertain the organization's ability to deliver a product or service that meets the customer requirements against a specification for delivery time. This may include the time book requisitions are delivered in the department and in schools, the invoices between the department and book suppliers, the actual delivery of books to schools. OTD can be measured as a percent achievement within a window of time that brackets the customer-requested date and/or the department's committed date which is the first day of the academic year.

2.7.2 ORDERING AND PROCUREMENT

The ECDoE Head Office evaluation process makes a first choice within the array of available offerings on the market, and compiles a catalogue of approved titles. It is then up to the schools to make their choices between the available options, refer to Appendix 3. At the moment, support for educators to make these choices is limited, and the process is not aligned to any training on curriculum changes. The textbook orders for any one year can be divided into three categories:

1. New materials orders: which are either whole grade or subject replacements;
2. Top-up orders: these orders are to fill the difference between stock in hand and learner numbers; and

3. Mop-up orders: these orders ensure a better distribution of supply by ensuring that orders are placed for schools that did not order themselves. There can be a mix of any one of the materials categories discussed in points 1 and 2.

Currently, these orders do not go out simultaneously as their timing and sequencing are not planned up front and are generally ad hoc. This means that the sequencing of orders carry neither the monetary efficiency gains from one process, nor the time efficiency gains of properly sequencing them. The value stream mapping reflected in Appendix 4 and 5 were applied to all three categories and it represents an average values for a typical mix of the three categories.

2.7.3 DELIVERY AND PAYMENT

Responsibility for the supply and delivery is split between the ECDoE and PASA, although accountability remains with the ECDoE. The Department manages all processes up to the placement of the orders. The costs of the supply chain up to this point are carried by the ECDoE budget. Once the orders have been placed, the publishers manage subsequent processes of the supply chain, up to the generation of verified invoices for payment. The processing of the invoices themselves is done within the ECDoE. The costs of the supply chain from delivery to distribution and verification of invoices are carried by the publishers, who withhold 15% of the standard books and offer 30% discount to the Department.

The procurement agreements for LSM are with individual publishers which are members of PASA.

2.7.4 DECISION-MAKING AND MANAGEMENT

Since 1994, textbooks' supply has been run in crisis mode. The low level of co-ordination between the chief directorate 'silos' for cross-cutting projects, such as textbooks supply, is exacerbated by the lack of a central control point for LSM (LSM

Review Report, 2003). Over the years, the ECDoE has appointed a LSM manager several times. However, this function was always added to existing heavy workloads. Also, the appointee was often too low down in the hierarchy. The extra burden on the appointed incumbent could result in one of the functions lagging behind. This was confirmed by Mrs "This portfolio was dumped to me". Further, the lower ranking of the position may lead to weakness in ensuring compliance with proposed timelines across other Directorates. This could result in insufficient integrated planning for LSM supply, insufficient pressure for timely decisions and actions and insufficient oversight and monitoring of compliance across the department with the critical path of the supply chain. This is an indication of a lack of dedicated leadership in the LSM Unit.

Further, asset management is adhoc and not fully enforced. The checks and balances on information, quantities ordered and types of LSM ordered are insufficient to preserve the integrity of the LSM process, and to ensure optimal supply.

2.7.5 BUDGETING

Textbooks supply require multi-year planning. The LSM Review Report (2003) discovered that there is no medium term policy in place to finance LSM needs. Despite an overarching multi-year budgeting framework, the financing of LSM is done annually. Therefore, the allocation of funds over the medium term at programme level within the provincial Mid Term Expenditure Framework (MTEF), is not taken through to the sub-programme level of LSM provisioning within the ECDoE. This means that the roll-out of curriculum changes is not coordinated with funding availability over the medium term, that schools cannot make trade-offs between their different needs over time, and that the timing of the LSM supply chain overall is totally dependent on the annual sub-programme allocation of resources. The provision of hard spending ceilings for schools, a critical incentive for improved budget and asset management, has been ambiguous, leading to over and under ordering, and to schools not taking responsibility for their LSM supply levels.

With the industry standard 30% discount in place, the current evaluation and cataloguing system, the ambiguous budget ceilings at school level, and the time pressure under

which educators must choose LSM, it is not clear that there is much competition between different publishers, on the basis of price and quality as negotiations are done by PASA, on behalf of publishers, and the Department. The competition and the greater efficiencies that may have been possible given hard budget ceilings and differences in price, are diminished through unclear responsibility for budgeting decisions and little clear and consistent regard for cost.

If a mathematical calculation is done on per learner allocation of LSM for 2005/6 financial year. Only R33 was portioned per learner in EC schools.

EC allocation 2005/6 = R68,405,000.83Total expenditure / 2065329 learners = R33.00. This is far too low compared to the minimum of R100 per learner stipulated in SASA.

Notwithstanding that new curriculum textbooks are planned to last three to five years and only top-up or supplementary budget is distributed yearly. The low budget allocation may constrain the Department to buy more for schools which may contribute to the shortage of textbooks at school level.

2.7.6 ROLE OF PRICEWATERHOUSE COOPERS/EAST LONDON COMPUTER BUREAU (PWC/ELCB)

PWC/ELCB consortium is one of the key players in the process of provisioning textbooks. The information management from this private sector consortium resulted from their involvement has played a paramount part in the efficacy of the improvements. According to LSM Review Report (2003) the staff deployed to the ECDoE Imbewu II contract and the PASA contract were critical holders of institutional learning on the management of the supply chain, both at a macro and micro level. Skills transfer was part of the agreement with the Consortium, but many factors mediated against the fulfillment of these objectives. While the current partnership frees up scarce capacity in the ECDoE towards other educationally core areas, the upshot is an ever-widening gap between the sophistication of the systems currently in use, and capacity in the ECDoE. There is little prospect of more capacity becoming available and the status quo is becoming entrenched.

While it is desirable for efficiency and effectiveness of LSM supply that one facility runs both the ordering and delivery information management systems, it is not desirable that the facility is employed under different contracts by the ECDoE as the purchaser, and PASA as providers of textbooks. The position of the Consortium raises conflict of interest issues. While the goodwill of suppliers is not in question, in principle, the involvement of the Consortium in the employ of the publishers for the later part of the chain conflicts with their involvement in the earlier part, where the number of books being ordered is determined.

2.8 CONCLUDING REMARKS

The restructuring that has taken place in the education system since 1994, while keeping considerable powers with the national government, has decentralised significant powers to the provincial governments within the context of South Africa's model of co –operative governance which allows for provincial participation in the decisions of national government. Furthermore, decentralisation has been taken to the level of the school and this is largely the result of the SASA through the introduction of SGBs.

Although equitable funding between Provinces has not bridged the infrastructure and material supply gap between poor and rich schools, it has moved in that direction. The funding of schools, both within and across Provinces has helped to curb the entrenched unequal system of public schooling. The inadequate public funding together with the private funding inherent in charging of school fees, has ensured that the more affluent communities continue to enjoy a far higher level of educational provision than less affluent ones (Gordon, Karlsson and Masipa, 2002).

There is evidence that resistance to school fees is growing, especially in poor communities (Gordon, Karlsson and Masipa, 2002). Also, among poor rural population the need to complete schooling is not perceived as a necessity as there are no apparent benefits in getting higher education (Wa Kivilu and Morrow, 2006). In many developing countries, school fees are the barrier to getting learners in school. Even in countries where primary education is

meant to be free, the cost of buying books and uniforms mean that many poor families cannot afford to educate their learners (Oxfam, 2001).

The FFC study in three provinces and practices in EC indicated serious challenges that include lack of planning by Provincial offices, procurement bottlenecks, migration of learners from rural to urban areas, lack of dedicated leadership. The KZN case study is an indication of the province that has succeeded in the supply of textbooks by outsourcing to two private companies.

The international trends shown by Le Métais (1996) suggest that most sampled countries in the international review operate free market systems of textbook production and supply, although there are some exceptions. Where it is the responsibility of the state (Provincial) government to prescribe acceptable textbooks, this is seen as a government's way of controlling curriculum and structure. However schools are responsible for sourcing the books.

The management of provisioning of textbooks in the EC still suffers in the evaluation and selection, ordering and procurement and delivery and payment processes. For the purpose of this study, activities in the ECDoE will be measured to evaluate the effectiveness and efficiency of the provisioning of textbooks supply which relates to the capability of ECDoE being responsive to the customer's (schools) needs.

CHAPTER 3 - LEAN THINKING

3.1 BACKGROUND

TOYOTA is one of the world's most studied and reported on companies, drawing the attention of journalists, researchers, and executives seeking to benchmark its famous production system (Spear and Bowen, 1999). For good reason: Toyota has repeatedly outperformed its competitors in quality, reliability, productivity, cost reduction, sales and market share growth, and market capitalization.

Following their own internal efforts to benchmark the world's best manufacturing company, General Motors, Ford, and Chrysler have independently created major initiatives to develop Toyota-like production systems but have not succeeded as Toyota has.
According to Spear and Bowen (1999), thousands of executives have toured Toyota's plants, frustrated by their inability to replicate Toyota's performance. Many visitors assume that the secret of Toyota's success must lie in its cultural roots, but that is not the case. Other Japanese companies, such as Nissan and Honda, have also fallen short of Toyota's standards. So why has it been so difficult to decode the Toyota Production System (TPS) which is seen as the key success factor? The answer is that observers confuse the tools and practices they see on their plant visits with the system itself. Activities and processes are constantly being challenged and pushed to a higher level of performance, enabling the company to continually innovate and improve.

The Toyota Production System (TPS) is not only for routine production work but also could be applied in service functions like equipment maintenance, workers' training and supervision, logistics and materials handling, process design and redesign (Wood, 2004). Lean thinking has also been successfully applied in improving process efficiency in South Africa's health care system (Booysen, 2006). Hence the system has been used to assess the supply of textbooks in this research. It was found that, for outsiders, the key is to understand that TPS creates a community of scientists. Spear (2004) argues that whenever Toyota defines a specification, it is establishing sets of hypotheses that can then be tested. In other words, it is

following the scientific method. To make any changes, Toyota uses a rigorous problem-solving process that requires a detailed assessment of the current state of affairs and a plan for improvement that is, in effect, an experimental test of the proposed changes. He further noted that with anything less than such scientific rigor, change at Toyota would amount to little more than random trial and error.

The fact that the scientific method is so ingrained at Toyota explains why the high degree of specification and structure at the company does not promote the command and control environment one might expect. Indeed, in watching people doing their jobs and in helping to design production processes, it has been learned that the system actually stimulates workers and managers to engage in the kind of experimentation that is widely recognized as the cornerstone of a learning organization. There are four main views that lean scholars discuss:

1) Womack and Jones (1996) confirmed that the tacit knowledge that underlies the Toyota Production System (TPS) can be captured in five basic rules:

   (a) Specify value in the eyes of the customer;
   (b) Identify the value stream and eliminate waste;
   (c) Make value flow at the pull of the customer;
   (d) Let customer "pull" value from the enterprise; and
   (e) Continuously improve in the pursuit of perfection.

2) Spear and Bowen (1999) indicate that the tacit knowledge that underlies the Toyota Production System can be captured in four basic rules. These rules guide the design, operation, and improvement of every activity, connection, and pathway for every product and service. The rules are as follows:

   Rule 1: All work shall be highly specified as to content, sequence, timing, and outcome.

   Rule 2: Every customer supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.

   Rule 3: The pathway for every product and service must be simple and direct.

   Rule 4: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.

3) EMS Consulting Group is one of the TPS House management consulting firms designed to create value for manufacturers, service providers, and product developers. The Group claims that Toyota has automobiles that are consistently at the top of the quality rankings; they have the fastest product development process in the world; and they are benchmarked as best-in-class for high quality, high productivity, manufacturing speed, and flexibility. The ultimate goal of lean is to increase cash flow and operating profits by:

   (a) Reducing inventory, delivery time, cycle time, and set-up time;

   (b) Improving quality;

   (c) Increasing overall customer satisfaction; and

   (d) Improving employee involvement, morale, and company culture.

4) Liker (2004) reflected that the Toyota Production System is underpinned by 14 principles organized in four sections: 1) Long-Term Philosophy, 2) The Right Process Will Produce the Right Results, 3) Add Value to the Organization by Developing Your People, and 4) Continuously Solving Root Problems Drives Organizational Learning, refer to Figure 2 below. The principles are set out and briefly described below:

   Section I — Long-Term Philosophy

   Principle 1: *Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.*

   Section 2 — The Right Process Will Produce the Right Results

   Principle 2: *Create a continuous process flow to bring problems to the surface.*

   Work processes are redesigned to eliminate waste (muda) through the process of continuous improvement i.e. kaizen. The eight types of muda are mentioned in this section 3.5 of this chapter.

   Principle 3: *Use "pull" systems to avoid overproduction.*

   A method where a process signals its predecessor that more material is needed. The pull system produces only the required material after the subsequent operation signals a need for it. This process is necessary to reduce overproduction.

Principle 4: *Level out the workload (heijunka).* This helps to achieve the goal of minimizing waste (muda), not overburdening people or the equipment (muri), and not creating uneven production levels (mura).

Principle 5: *Build a culture of stopping to fix problems, to get quality right the first time.* Quality takes precedence (Jidoka). Any employee in the Toyota Production System has the authority to stop the process to signal a quality issue.

Principle 6: *Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.* Although Toyota has a bureaucratic system, the way that it is implemented allows for continuous improvement (kaizen) from the people affected by that system. It empowers the employee to aid in the growth and improvement of the company.

Principle 7: *Use visual control so no problems are hidden.*

Included in this principle are the 5Ss - steps that are used to make all work spaces efficient and productive, help people share work stations, reduce time looking for needed tools and improve the work environment.

Principle 8: *Use only reliable, thoroughly tested technology that serves your people and processes.* Technology is pulled by manufacturing, not pushed to manufacturing.

Section 3 — Add Value to the Organization by Developing Your People

Principle 9: *Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.* Without constant attention, the principles will fade. The principles have to be ingrained, it must be the way one thinks. Employees must be educated and trained: they have to maintain a learning organization.

Principle 10*: Develop exceptional people and teams who follow your company's philosophy.* Teams should consist of 4-5 people and numerous management tiers. Success is based on the team, not the individual.

Principle 11: *Respect your extended network of partners and suppliers by challenging them and helping them improve.* Toyota treats suppliers much like they treat their employees, challenging them to do better and helping them to achieve it. Toyota provides cross functional teams to help suppliers discover and fix problems so that they can become a stronger, better supplier.

Section 4: Continuously Solving Root Problems Drives Organizational Learning

Principle 12: *Go and see for yourself to thoroughly understand the situation.*

Toyota managers are expected to "go-and-see" operations. Without experiencing the situation firsthand, managers will not have an understanding of how it can be improved.

Principle 13: *Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.* The following are decision parameters:

(a) Find what is really going on (go-and-see) to test
(b) Determine the underlying cause
(c) Consider a broad range of alternatives
(d) Build consensus on the resolution
(e) Use efficient communication tools

Principle 14: *Become a learning organization through relentless reflection (hansei) and continuous improvement (kaizen).* The process of becoming a learning organization involves critically examining every aspect of what one does.

These rules guide the design, operation, and improvement of every activity, connection, and pathway for every product and service. Lean Thinking was adapted by Womack and Jones (1996) as an American version of TPS. Schonberger (1996), in the 5th customer-focused principle suggests cutting out wasteful areas to increase "time-to-markert and quick-response management.

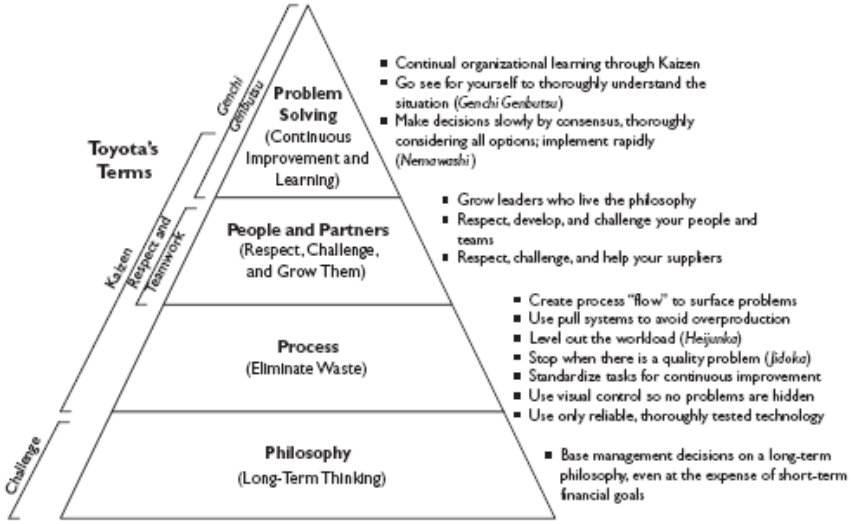


Figure 2:

Showing 4P model of the Toyota Way **Source: Liker, 2004**

3.2 INTRODUCTION

The primary purpose of this study is to evaluate the delivery of education by the Eastern Cape Department of Education (ECDoE) to its citizens. The focal point is the delivery and supply of textbooks by the Department to public schools. The study evaluates the effectiveness of the supply, the supporting budget, processes, resources, timing, systems and organizational structures so that textbooks are delivered to schools before the beginning of each year. There is a wide spread view that some schools do not receive textbooks on time or that some learners do not receive them at all (PSAM, 2004; FFC, 2005). This problem has led to classroom learning and teaching time being lost, thus possibly leading to pass rates being compromised. The Lean Thinking principles and the Value Stream Mapping (VSM) tool will be used to measure the effectiveness of textbook supply. Lean Thinking is a derivative of the TPS (Womack and Jones, 1996). The research questions being posed are as follows:

Q1: How does the implemented policy for delivery and supply of textbooks to schools by the ECDoE assist in the efficiency of the supply?

Q2: How can Value Stream Mapping (VSM) be used to describe the process of supplying textbooks in the ECDoE public schools?

Q3: How can VSM be applied to expedite the material and information flow between the role players, namely Administrators at the Head Office (Zwelitsha), District Offices and schools in the supply and distribution of textbooks?

Q4: How can VSM be used to identify non-value adding activities (waste) and, based on the findings recommend improvements?

Q5: How can the application of Lean Thinking principles, philosophies and tools contribute to the improvement in the supply of textbooks to EC public schools, as measured by reduced time in the system?

Lean principles and TPS are evolving and have proven to be successful at improving company results and will be applied to measure the process of provisioning of textbooks in the EC public schools.

Different approaches to TPS			
Womarck and Jones	**Spear and Bowen**	**EMS Group**	**Liker**
Specify value in the eyes of the customer;	All work shall be highly specified as to content, sequence, timing, and outcome.	Reducing inventory, delivery time, cycle time, and set-up time	*Long-term thinking in decision making*
Identify the value stream and eliminate waste;	Every customer supplier connection must be direct, **and** there must be an unambiguous yes-or-no way to send requests and receive responses.	*Improving quality*	Processes: Eliminate waste (muda)
Make value flow at the pull of the customer;	The pathway for every product and service must be simple and direct.	Increasing overall customer satisfaction	People and Parners: respect, challenge and grow them
Let customer "pull" value from the enterprise; and	Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.	Improving employee involvement, morale, and company culture.	Problem solving by Continuous improvement and Learning
Continuously improve in the pursuit of perfection.			

Table 4: Showing diffent principles of TPS/Lean Thinking

After thourough consideration of the four approaches, there are few differences between the TPS principles (rules) that were reflected by mentioned lean scholars in Table 4 above . However, long-term thinking in decision making from Liker (2004) and Improving quality from EMS Group were major differences. Liker (2004) describes the long-term philosophy as work, grow, and align the whole organization towards a common purpose that is bigger than making money. In generating value for the customer, society, and economy smaller steps are taken to improve delivery, skills and alignment for long term gains.

The improvement of quality as a principle mentioned by EMS Group is viewed as a result or consequence of the prudent process(es)/principle(s) by other lean scholars. Spear and Bowen (1999), Liker (2004) and Womack and Jones (2003) mention that for Toyota's workers, the output of an ideal person, group of people, or machine, that is quality work are:

a) defect free (that is, it has the features and performance the customer expects);
b) can be delivered with one request at a time (a batch size of one);
c) can be supplied on demand in the version requested;
d) can be delivered immediately;
e) can be produced without wasting any materials, labour, energy, or other resources (such as costs associated with inventory); and
f) can be produced in a work environment that is safe physically, emotionally, and professionally for every employee.

Thus, five common rules were chosen to represent Lean philosophy, thus applied on this study that is intented to improve quality, value for customer and shorten to delivery and , refer to section 3.2.2 – 3.2.6.

3.2.1 HISTORY - TOYOTA'S EARLY STRUGGLES

Taiichi Ohno, the chief architect of lean manufacturing, developed its core elements at Toyota Motor Corporation in Japan in the period between 1950 and 1955. During this five-year learning period, Ohno made many experiments in the machine-intensive production shops that he managed. Levels of demand in the post World War II economy of Japan were low and the focus of mass production on lowest cost per item via economies of scale had little relevance (Kahn and Mello, 2004). Having visited and evaluated supermarket operations in the US, Taiichi Ohno recognised that the scheduling of work should not be driven by sales or production targets but by actual sales. Given the financial situation during this period, over production was not an option and thus the notion of Pull (rather than sales target driven Push) came to underpin production scheduling. Key concepts such as time, process flow, standardized work, single minute exchange of die, and basic pull system mechanics were all tested and worked out under his supervision.

Unfortunately very little was written down about what Ohno did (Kahn and Mello, 2004). Today we only hear of the success stories about Lean Production and the impressive nature of the TPS. The interviews and conversations conducted by Womack and Jones with retired Toyota executives, it was discovered that they have a different perspective about how difficult it was to establish the basic tenets of Lean Production. These comments are typical reflections:

1. "*Our die changeover process was terrible, and took anywhere from one to two shifts to complete. Then the initial part quality was never any good."*
2. *"Our precision machine tools were all from Germany or the United States. Our uptime averaged 50-60% at best and we struggled with the foreign documentation and delivery of spare parts from overseas."*
3. *"We never had the production parts that we needed when we needed them. Materials were scarce and we always seemed to make too much of the wrong thing."*

4. *"Our employees wanted to only work one machine and work at their own pace. Virtual mountains of WIP existed between processes as machine speeds were not synchronized to customer demand (takt time) at all."*

According to Hines et al (2004), what Toyota earlier learned the hard way is that in the beginning of a transformation there needs to be a lot of basic stability before proceeding with the more sophisticated elements of Lean Production. Lean Production implementers could draw encouragement from these early struggles by Toyota. The implementation of Lean may not be easy and straightforward even in the ECDoE and culture change may be necessary.

The fact that the scientific method is so ingrained at Toyota explains why the high degree of specification and structure at the company does not promote the command and control environment one might expect (Spear, 2004). The tacit knowledge that underlies TPS can be captured in five basic rules as discussed below (Spear and Bowen, 1999; Liker, 2004; EMS Group; 2004; and Womack & Jones, 1996).

3.2.2 DEVELOP A PLAN FOR EVERY PART (PFEP).

Rule 1: All work shall be highly specified as to content, sequence, timing, and outcome.

The exactness of design, operation, activity, connection and path is applied not only to the repetitive motions of production workers but also to the activities of all people regardless of their functional specialty or hierarchical role (Spear and Bowen, 1999). The requirement that every activity be specified is the first unstated rule of the system. For instance, new operators/officials are usually trained by experienced workers, who teach by demonstrating what to do. A seasoned colleague might be available to help a new operator with any difficulties, such as failing to tighten a bolt enough or forgetting to enter the computer code.

This sounds straightforward, so what's wrong with it? The problem is that those specifications that allow and even assume variation in the way employees do their work can translate into poorer quality, lower productivity, and higher costs. More important, it

hinders learning and improvement in the organization because the variations hide the link between how the work is done and the results (Spear and Bowen, 1999). At Toyota's plants, because operators (new and old, junior and supervisory) follow a well-defined sequence of steps for a particular job, it is instantly clear when they deviate from the specifications.

The development of a centralised spreadsheet or database fosters accurate and controlled inventory reduction and is the important for the identification of parts in the material-handling system. This is the first step because it will use this data in other steps, such as setting up the purchased parts market and establishing pull signals. To create the Plan For Every Part (PFEP), there is a need to gather essential information on every part number entering the plant, such as the part's specifications, supplier, location of supplier, rate of usage, storage locations, point of use, container size, as well as other key data (Womack and Jones, 1996).

Managers are making progress in creating areas of continuous flow as more managers learn about value-stream mapping and continuous-flow cells but many are having trouble sustaining steady output (Rother and Shook, 1999). The problem often is the lack of a lean material-handling system for purchased parts to support the cells.

To introduce such a system, an understanding of everything about every part or activity is required: How each part is purchased, received, packaged, stored, and delivered to its point of use. In fact, much of this information exists in organizations, but it is stored in many different places under the control of many managers and is mostly invisible. The first step in creating a lean material-handling system for purchased parts is collect all of the necessary parts information in one place, the PFEP, refer to Table 5 below.

Table 5: PFEP Data Elements

Part #	Number used to identify the material in the facility
Description	Material name (e.g., frame, bolt, nut, yoke, book)
Daily Usage	Maximum amount of material used in a day through the entire

	plant
Usage Location	Process/areas where the material is used (e.g., Cell 14)
Storage Location	Address (location) where the material is stored
Order Frequency	Frequency that the material is ordered from the supplier (e.g., daily, weekly, monthly, as required)
Supplier	Name of the material supplier
Supplier City	City where the supplier is located
Supplier State	(State, province, region, district) where the supplier is located
Supplier Country	Country where the supplier is located
Container Type	Packaging type of the container (e.g., cardboard box, reusable tote, wire basket)
Container Weight	Weight of an empty container
1 Part Weight	Weight of 1 unit of material
Total Package Weight	Weight of a full container of material
Container Length	Length or depth of the container
Container Width	Width of the container
Container Height	Height of the container
Usage Per Assembly	Number of parts required for 1 finished product
Hourly Usage	Maximum number of pieces used per hour
Standard Container Quantity	Piece count of material in one container
Containers Used Per Hour	Maximum number of containers required per hour
Shipment Size	Size of a standard shipment in days (1 week shipment = 5 days)
Carrier	Company providing parts-transportation services
Transit Time	Travel time required from the supplier to the facility (in days)
# of Cards In Loop	Number of pull signals that are in the system

Supplier Performance	Supplier performance rating that includes on-time delivery, quality, etc.

Source: *Making Materials Flow* workbook, Lean Enterprise Institute, www.lean.org

Table 5 above shows the most common categories of parts information for a PFEP. Every plant and service is different. There could be a need to add columns and take out ones that are not useful. Furthermore, as conditions change, the specific items in the PFEP may need to change. The watchword for the PFEP is flexibility, hence there is a need to ensure that the information management system is able to accommodate continuous change (Liker and Meier, 2005).

The information in the PFEP is usually made visible to everyone in the facility/department, and need to sort the PFEP by categories (e.g., part description, order frequency, container type, and hourly usage). A computer spreadsheet (such as Excel) or computer database (such as Access) to house the PFEP is necessary. Most facilities start with an Excel spreadsheet. The organisation may someday migrate the data into an Access database, but it's important to use a tool that is user friendly and has sorting capabilities.

By establishing a dedicated PFEP manager and developing precise guidelines for changes in any information in the PFEP, this will ensure that the PFEP is always up-to-date and accompanied by a paper trail of changes. If done properly, this also makes it impossible to change a part on the floor without communicating that change to all affected departments.

The PFEP, once carefully established, filled with parts information, and properly managed, enables the organization to:

- Begin creating a lean material-handling system and subsequently developing purchased-parts market, delivery routes, and pull signals;
- Store pertinent current data on all parts in one central, accessible location;
- Sort parts data by various categories, such as container size, supplier location, and usage;
- Provide a quick response to operations questions regarding parts and suppliers; and
- Extend the lean material-handling system to your plant-to-plant material movements.

Applying the above to this study, in the second quarter of every year, the ECDoE district offices distribute the textbook catalogues and requisition forms to all the schools in their jurisdiction throughout the Province, refer to Appendix 3. The information in the requisition forms satisfies the requirements in the PFEP, however the return date and to who's attention to the provincial office are missing. This has led to schools returning later than the anticipated date which is the last day of the second month. This causes significant delays.

The ECDoE does not have a clear procedure for the supply of LSM of which textbooks constitute over 80%. There is a framework or guideline adopted from the LSM Review Report (2003) that is being used for the supply and distribution of textbooks to schools. The current guideline gives an overview of the process flow, but does not detail the process from one stage to the next. This places reliance on memory and experience, hence the lack of a clear procedure for the process has contributed to lack of delivery of the materials to schools in a system that was started more than a decade ago.

3.2.3 BUILD A CUSTOMER SUPPLIER CONNECTION

Rule 2: Every customer supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.

Where the first rule explains how people perform their individual work, the second rule explains how they connect with one another. Every connection must be standardized and direct, unambiguously specifying the people involved, the form and quantity of the goods and services to be provided, the way requests are made by each customer, and the expected time in which the requests will be met (Rother and Harris, 2001).

The rule creates a supplier-customer relationship between each person and the individual who is responsible for providing that person with each specific item or service. As a result, there are no gray zones in deciding who provides what to whom and when. When a worker makes a request for parts, there is no confusion about the supplier, the number of units required, or the timing of the delivery. Similarly, when a person needs assistance, there is no confusion over who will provide it, how the help will be triggered, and what services will he delivered.

In the case of supply of textbooks, the schools submit the requisitions to the district office, but to who in the district office is sometimes not clear. Thus, the submissions can get lost in the district office (FFC, 2005). Rule number 2 requires that the line of connection must be to a specific machine or person. In the case of the Port Elizabeth district office, they should be submitted to supply chain officer, Mr J Tutu. There is no response system if the district office or ECDoE has received the schools and vice versa. This confirmation can ensure there are less unbudgeted books through mop-up orders.

3.2.4 DESIGN DELIVERY ROUTES

Rule 3: The pathway for every product and service must be simple and direct.

All production lines at Toyota have to be set up so that every product and service flows along a simple, specified path. That path should not change unless the production line is expressly redesigned (Womack and Jones, 1996). In principle there are no forks or loops to convolute the flow in any of Toyota's supply chains. In accordance with Rule 3, goods and services do not flow to the next available person or machine but to a *specific* person or machine. If for some reason that person or machine is not available, Toyota will see it as a problem that might require the line to be redesigned.

The stipulation that every product follows a simple, pre-specified path does not mean that each path is dedicated to only one particular product, quite the contrary (Rother and Harris, 2001). Each production line at a Toyota plant typically accommodates many more types of products than its counterparts do at other companies.

The third rule runs contrary to conventional wisdom about production lines and pooling resources. The normal practice is that as a product or service is passed down the line, it should go to the next machine or person available to process it further (Hines et al 2004). Similarly, most people assume that help should come from the first available person rather than from a specific person. Here the hypothesis embedded in a pathway designed according to Rule 3 is that every supplier connected to the pathway is necessary, and any supplier not connected is not necessary.

For the purpose of this research, the provincial Department in Zwelistha acts as a supplier of a service and schools as customers or recipients of that service. Rule 3

requires that the path should be simple and direct. In this research, it has been noted that the requisitions move from schools to district offices and then to the provincial office. According to Mr J Tutu (2008), “the requisitions are collected and sent to the provincial office that will process them”, thus there is no value-adding activity in the district office. Even though some schools do not have emails and internet connections, there is a possibility to send a direct facsimile to the ECDoE which can improve the process.

According to the Rule 3, the district office stage adds no value and has often introduced delays, thus it can be defined as waste (*muda*).

3.2.5 IMPLEMENT PULL SIGNALS

Rule 4: Every part must be manufactured for a specific customer and manufactured when needed. A customer should “pull” the value from the enterprise.

The proposition in Rule 4 is that, instead of using sales forecasts, the ability to design, schedule and make exactly what the customer wants, when the customer wants it, means the customer can pull products directly from the production as and when they need it (Spear and Bowen, 1999). Signals, such as the familiar visible kanban (product) card, control the precise times and quantities of parts delivered to cells. There must be a precise control on the number of kanban circulating in the system. The first step is to determine how frequently to deliver materials to cells, and whether the route is "coupled" or "decoupled." In a coupled route, the tugger driver loads carts in the market and drives them to the cells, and delivers them to the point of use (Liker and Meier, 2005). In a decoupled route, the work is divided between a market attendant who loads parts and the driver who delivers them. Decoupled routes require two sets of carts to improve labor utilization, so routes can be longer and have more carts. The type of route affects the number of kanban needed for each part. Coupled routes require kanban equal to three times the delivery frequency and decoupled routes need signals equal to four times the delivery frequency (Liker and Meier, 2005). The formula for figuring the total number of kanban for a decoupled route looks like this:

(Hourly usage x 4 x route frequency)
Standard container quantity

Example: For Part #12345, the usage is 90 per hour, there is one cycle of the route, and a container holds 30 parts. (Always round up to the next whole number.)
(90 x 4 x 1)/30 = 12 kanban

All the rules require that activities, connections, and flow paths have built-in tests to signal problems automatically. It is the continual response to problems that makes this seemingly rigid system so flexible and adaptable to changing circumstances.

Every year schools require textbooks whether as a mop-up, top-up or a complete new set as a result of the introduction of a new curriculum. This creates a push signal for ECDoE on which books and the volumes that are needed. It is also difficult for the Department to forecast accurately the number of learners who will require textbooks because of leaner dropouts, learner repeaters, book damages and lost books. However, the estimates are based on previous years requirements and availability of funds.

3.2.6 CONTINUOUSLY IMPROVE THE SYSTEM.

Rule 5: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.

Spear and Bowen (1999) indicate that identifying problems is just the first step and for people to consistently make effective changes for improvements, they must know how to change and who is responsible for making the changes. Toyota explicitly teaches people how to improve, not expecting them to learn strictly from personal experience. Cooney (2002) argues that, Rule 5 stipulates that any improvement to production activities, to connections between workers or machines, or to pathways must be made in accordance with the scientific method, under the guidance of a teacher (sensei in Japanese), and at the lowest possible organizational level.

Workers are assigned a leader (sensei) who trains them to frame problems better and to formulate and test hypotheses, in other words, teaches them how to use the scientific method to design their team's work in accordance with the first four rules. The results are highly impressive. To make changes, people are expected to present the explicit logic of the hypothesis by:

a) teachers trying to get them to realize that they had not fully explored all their improvement opportunities and assumptions have not been questioned deeply enough.
b) teachers trying to show the group members that their improvement activity had not been carried out as a bona fide experiment.

For instance, in a production line, the workers may have established a goal of five minutes based on the premise that faster changeovers and smaller batches are better than slower changeovers and larger batches. In this case, the workers were confusing goals with predictions based on hypothesis. The goal is not a prediction of what they believed they would achieve through the specific improvement steps they planned to take. The teacher encourages learners to design the improvement effort as an experiment with an explicit, clearly articulated, verifiable hypothesis of the form, "If we make the following specific changes, we expect to achieve this specific outcome." (Spear and Bowen, 1999). Although they could reduce the changeover time considerably, they had not tested the hypotheses implicit in their effort.

Who does the Improvement? Front-end workers make the improvements to their own jobs, and their supervisors provide direction and assistance as teachers. If something is wrong with the way a worker connects with a particular supplier within the immediate assembly area, the two of them make improvements, with the assistance of their common supervisor.

When changes are made on a larger scale, Toyota ensures that improvement teams are created consisting of people who are directly affected and the person responsible for supervising the pathways involved. Thus the process remains the same even at the highest levels.

Experience has taught Toyota that the best way to sustain and improve the system is to have daily monitoring of the system and periodic auditing. For instance, the production control supervisor should spend about an hour a day observing various elements of the routes and purchased-parts market. The material-handling team should meet at the production line daily to communicate problems and seek solutions. Key performance metrics focused on such factors as delivery, productivity, and safety should be established for the team. The daily monitoring must be supported by periodic audits done by overlapping levels of management to make sure that the new tools, the PFEP, the purchased-parts market, the delivery routes, and the pull signals are being maintained and that standard work is being followed. Emphasize to people that processes, not individual employees, are being audited. Post results for everyone to see. This suggests that the ECDoE LSM Programme Manager should be spending time in the production line, district offices, schools, publishers, distributors and with data capturers so that there can be direct observance of performance in the value chain leading to suggested improvements based on actual experience. Also Rule 5 suggests that decision making for textbooks should be at the lowest credible level e.g. schools choosing books or suppliers which is partially the case in the Department schools. Schools choose from a pre-approved list of books and suppliers. The benefits of this decision making arrangement will be discussed in Chapter 5.

3.3 TOYOTA'S NOTION OF IDEAL

The TPS is based on two guiding principles (Mishina and Takeda, 1995:2), namely:

- *Just-in-time (JIT)* – produce only what is needed, only how much is needed and only when needed. Any deviation from true production needs is condemned as waste.
- *Jidoka* – make any production problem instantly self-evident and stop producing whenever a problem is detected. It insists on building in quality in the production process and condemns any deviation from value-addition activities as waste.

Thus the “needs” and “value” of TPS are defined from the view point of the next station down the line, that is the immediate customer. Muda as waste is known in Japanese, is defined by

Womack and Jones (1996:15) as any human activity that absorbs resources but creates no value. Spear and Bowen (1999) confirm that Toyota workers define the outputs of an ideal person, group of people, or machines are:

- defect free (that is, it has the features and performance the customer expects);
- can be delivered with one request at a time (a batch size of one);
- can be supplied on demand in the version requested;
- can be delivered immediately;
- can be produced without wasting any materials, labour, energy, or other resources (such as costs associated with inventory); and
- can be produced in a work environment that is safe physically, emotionally, and professionally for every employee.

Liker and Meier (2005) consistently found people at plants that used TPS make changes that pushed operations toward this ideal. If the rules make companies using the TPS a community of scientists performing continual experiments, then why aren't these organizations in a state of chaos? Why can one person make a change without adversely affecting the work of other people on the production line? How can Toyota constantly introduce changes to its operations while keeping them running at full tilt? In other words, how does Toyota improve and remain stable at the same time?

The answer is in the rules. By making people capable of and responsible for doing and improving their own work, by standardizing connections between individual customers and suppliers, and by pushing the resolution of connection and flow problems to the lowest possible level, the rules create an organization with a nested modular structure (Mishina and Takeda, 1995). The great benefit of nested modular organizations is that people can implement design changes in one part without unduly affecting other parts.

3.4 HOW TO LEARN THE TOYOTA PRODUCTION SYSTEM

The methodology of the training described below is consistent and specific in that it reveals the above mentioned five fundamental principles underlying the TPS. Together with the rules

described above, the following lessons may help to explain why Toyota has remained the world's pre-eminent manufacturer.

Learning and training the TPS involves direct observation of the machines and the people working around them until the defect or failure occurs. Then a plan to eliminate that particular cause of failure would be employed. The process follows direct observation of the devices, root-cause analysis of each fault, and proposal for immediate reconfiguration to remove suspected causes and measuresment of outcome. Spear and Bowen (1999) suggest that there are four methods to learn TPS, namely:

a) *Direct observation.*

The trainee is required to watch employees work and machines operate. The incumbent is asked not to "figure out" why a machine had failed, as if he were a detective solving a crime already committed, but to sit and wait until he could directly observe its failure - to wait for it to tell him what he needed to know. This requires the Programme Manager in the LSM Unit to directly observe the process from filling forms at schools, delivery to the district office, processing in the ECDoE Head Office and delivery to schools. This will give a better insight, appreciation and understanding of the process with little reliance on others. Also, any changes should be documented to enhance learning and institutional memory for continuous improvement.

b) *Proposed changes should always be structured as experiments.*

In the scientific method, experiments are used to test a hypothesis, and the results are used to refine or reject the hypothesis. The learner's problem solving should be structured so that embedded in it are explicit and testable assumptions in the analysis of the work. Throughout training, the incumbent has to explain gaps between predicted and actual results.

c) *Workers and managers should experiment as frequently as possible.*

At Toyota, the focus is on many quick, simple experiments rather than on a few lengthy, complex ones. This encourages trainees to learn from making small incremental changes rather than large system-design changes. The learner would observe work actually being done, quickly see where problems were occurring, then rapidly test his/her understanding by implementing a countermeasure, thereby accelerating the rate at which s/he discovered

"contingencies" or "interferences" in the process. This is precisely the way Toyota workers practice process improvement. *They cannot "practice" making a change, because a change can be made only once. But they can practice the process of observing and testing many times.*

d) *Managers should coach, not fix.*

The training not only gives an insight into how Toyota delivers continuous improvement but also helps in understanding the unique relationships between Toyota's managers and workers as one with a more participative and inclusive approach than most. The workers and low-level managers constantly solve problems. Indeed, the more senior the manager, the less likely s/he was to be directly involved in solving problems.

3.5 LEAN THINKING

The term Lean Thinking was first defined in the 1990's in a book called *The Machine that Changed the World: The Story of Lean Production* (Womack and Jones, 1996). The book chronicles the transitions of automobile manufacturing from craft production to mass production to lean production. The book also affirms that Lean Thinking principles are based on the Toyota Production System (TPS). Womack and Jones (1996) identified five core Lean Thinking concepts, which are:

a) Specify value in the eyes of the customer;
b) Identify the value stream and eliminate waste;
c) Make value flow at the pull of the customer;
d) Let customer "pull" value from the enterprise; and
e) Continuously improve in the pursuit of perfection.

The points above are similar to the underlying manufacturing philosophy of TPS as discussed in section 3.2. Lean Thinking can be defined as a cyclic process of seeking perfection by eliminating waste and thereby enriching value from a customer perspective (Hines et al, 2004). By understanding processes and identifying non-value adding waste through root cause

identification, the Lean organization seeks to eliminate waste and create a continuous pull flow within the processes of the value stream by involving key partners in the process that seeks to eliminate non-value adding activities (Liker and Meier, 2005). In this instance, the aim is to reduce the delays in the delivery of school textbooks. According to Liker and Meier (2005) Lean Manufacturing is "A systematic approach to identifying and eliminating waste through continuous improvement by flowing the product at the demand of the customer."

Hines et al (2004) provide a brief history of Lean Thinking and confirm that the first English language text was only available in the early 1980's. The evolution is summarised in the following Table 6 below. In brief, the literature of the early 1990's focused on quality, that of late 1990's focused on quality, cost and delivery and from 2000 onwards, the focus was on the value to the customer (Hines et al 2004).

Table 6: The evolution of Lean Thinking adapted from Hines et al (2004)

Phases	**1980 – 1990 Awareness**	**1990-mid 1990s Quality**	**Mid 1990 – 2000 Quality, cost & delivery**	**2000+ Value system**
Literature theme	Dissemination of shop floor practices	Best practice movement, benchmarking leading to emulation	Value stream thinking, lean enterprise, collaboration in supply chain	Capability at system level
Focus	JIT techniques, cost	Cost, training and promotion, TQM, process re-engineering	Cost, process-based to support flow	Value and cost, tactical to strategic, integrated to supply chain
Key business process	Manufacturing, shop-floor only	Manufacturing and material management	Order fulfilment	Integrated processes, order fulfillment and new product development

Industry sector	Automotive – vehicle assembly	Automotive – vehicle and component assembly	General manufacturing, repetition	High and low volume manufacturing, extension into service sectors
Authors	Shingo (1981, 1988) Schonberger (1982, 1986) Monden (1983) Ohno (1988) Mather (1988)	Womack and Jones (1990) Hammer (1990) Stalk and Hout (1990) Harrison (1992) Anderson Consulting (1993, 1994)	Lamming (1993) Macbeth and Ferguson (1994) Womack and Jones (1994, 1996) Rother and Shook (1998)	Bateman (2000) Hines and Taylor (2000) Holweg and Pil (2001) Abbas et al (2001) Hines et al (2002)

Source: Hines et al (2004)

Womack and Jones (1996) and Liker and Meier, (2005:35) suggest eight types of muda. Seven were already identified by Toyota's Ohno, and McKellen (2004). These types of waste are summarised below.

1. **Overproduction** – Overproduction simply means producing more than what is actually needed by an upstream process or customer. On the shop floor, this generally occurs because changeover times are high, equipment is unreliable, the process is unreliable (causes defects), and standard cost accounting metrics are used. In the extended value stream, overproduction certainly occurs for some of these same reasons. However, probably the biggest reason for overproduction is poor information flow (communication) between facilities. Improved information flow between facilities is one of the key characteristics of a lean extended value stream.
2. **Transportation** – Moving product does not create value; this is amplified when examining the extended value stream. Unnecessary transportation is generally caused by making supplier selection decisions based on single points in a value stream rather than

seeking to optimize the entire value stream. Proper selection of supplier/facility location is critical to a lean value stream.

3. **Unnecessary Inventory** – For the extended value stream map, unnecessary inventory is generally the result of poor information flow and batch processing. Suppliers often hold inventory to support a lean customer; this ultimately gets passed on to the customer in the form of higher pricing and/or poor quality. Sometimes, suppliers and their customers are holding redundant inventory. Extended value stream mapping will expose this waste.
4. **Inappropriate Processing** – In the door-to-door value stream, this usually refers to using larger scale equipment than necessary; it also refers to building in rework to a process. In the extended value stream, it can also refer to using the wrong suppliers and/or the wrong process. With regards to rework, many times organizations rework parts after they come in from a supplier simply because of poor communication between facilities.
5. **Waiting** – This waste refers to operators waiting for machines as well as product waiting (inventory). This waste is generally the same for the extended value stream as the door-to-door value stream.
6. **Excess Motion**- Generally, this waste applies to production personnel having to move out of their work area to locate tools, materials, etc.
7. **Defects**- This waste refers to defective product and information (paperwork). Its unique application to the extended value stream is defective product moving between facilities. This results in additional waste in the form of excess inventory, rework or disposal material.
8. **Underutilization of Employees' Minds or Ideas** – This waste could be changed to "Underutilization of Suppliers' and Customers' Minds/Ideas." Organizations rarely approach their customers and suppliers to leverage their know-how with respect to manufacturing processes, information processing, and product design. This is a significant waste of the extended value stream.

9. From Liker (2004), additional non-value adding activities may be generated from **Uneveness (Mura) and Overexertion (Muri).**

   Mura: unevenness may result from an irregular production schedule or fluctuating production volumes due to internal problems, like downtime or missing parts or defects.

Mira: overburdening people or equipment is by pushing a machine or person beyond natural limits. Overburdening people may result in safety and quality problems and Overburdening equipment may lead to breakdons and defects.

By eliminating waste (muda), quality is improved, production time and costs are reduced. To solve the problem of waste, Lean Thinking has several "tools" at its disposal such as 5S, 5 Why, 4M, Quick Changeover¸ Total Productive Maintenance (TPM) and others . These include constant process analysis (kaizen), "pull" production (by means of kanban) and mistake-proofing (poka-yoke). To eliminate waste, the Hirano (1995) 5S process will be used. The primary purpose of this is likened to *"clearing the clots"*. The sub-components of the 5S process are illustrated below: Sort, Straighten, Shine, Standardize and Sustain.

3.5.1 WHAT IS 5S?

Hirayuki Hirano in his book called *5 PILLARS OF THE VISUAL WORKPLACE : The Sourcebook for 5S Implementation* explains five practical steps that can be used to eliminate waste. Five S model is a method for organizing a workplace, especially a shared workplace, like a shop floor or an office space, and keeping it organized. It's sometimes referred to as a housekeeping methodology, however this characterization can be misleading because organizing a workplace goes beyond housekeeping.

The key targets of 5S are workplace morale and efficiency. The assertion of 5S is that by assigning everything to a location, time is not wasted by looking for things. Additionally, it is quickly obvious when something is missing from its designated location. 5S advocates believe the benefits of this methodology come from deciding *what* should be kept, *where* it should be kept, and *how* it should be stored. This decision making process usually comes from a dialog about standardization which builds a clear understanding, between employees, of how work should be done. It also instills ownership of the process in each employee. Hirano (1995) explains 5S's as being:

***Seiri**: Sorting*. Refers to the practice of going through all the tools, materials and equipments in the work area and keeping only essential items. Everything else is stored or discarded. This leads to fewer hazards and less clutter to interfere with productive work. The provincial LSM undertakes an annual survey to keep the information and data for schools so that there is no mix up. The information should only be sent to where it is going to be used. Again, the requisition forms are not used in the district offices but in the provincial office data capturing unit.

***Seiton**: Simplifying*. This centers around the need for an orderly workplace. Orderly in this sense means arranging the tools and equipment in an order that promotes work flow. Tools and equipment should be kept where they will be used, and the process should be ordered in a manner that eliminates extra motion.

***Seisō**: Sweeping, Systematic Cleaning, or Shining*. Indicates the need to keep the workplace clean as well as neat. Cleaning in Japanese companies is a daily activity. At the end of each shift, the work area is cleaned up and everything is restored to its place. Making it easy to know what goes where and to know when everything is where it should be are essential here. The key point is that maintaining cleanliness should be part of the daily work - not an occasional activity initiated when things get too messy.

***Seiketsu**: Standardizing*. This refers to standardized work practices, which is more than standardized cleanliness (otherwise this would mean essentially the same as "systemized cleanliness"). This means operating in a consistent and standardized fashion. Everyone knows exactly what his or her responsibilities are. In part this follows from Seiton where the order of a workplace should reflect the process of work, these imply standardised work practices and workstation layouts.

***Shitsuke**: Sustaining*. Refers to maintaining and reviewing standards. Once the previous four points above have been established they become the new way to operate. Maintain the focus on this new way of operating, and do not allow a gradual decline back to the old ways of operating. However, when an issue arises such as a suggested improvement or a new way of working, or a new tool, or a new output requirement then a review of the first four points is appropriate.

3.5.2 IMPLEMETATION OF LEAN THINKING

The first step in Lean Thinking is to understand what value is from the customer's viewpoint and what activities and resources are necessary to create that value. Once this is understood, everything else is waste (Liker and Meier, 2005). Since no one wants to consider what they do as waste, the job of determining what value is and what adds value is something that needs to be done at a fairly high level. For example, new order tracking software needs to be developed. It is self-evident that it is very important for a customer to know the status of their order, so clearly this would add customer value. But in practice, if the order is in house for less than 24 hours, the only order status that is necessary is to inform the customer that the order was received, and then that it has been shipped, and let them know the shipping tracking number. If the order can be fulfilled by downloading it on the Web, there really isn't any order status book necessary at all. To develop breakthroughs with Lean Thinking, the first step is learning to see waste. If something does not directly add value, it is waste. If there is a way to do without it, it is waste.

Womack and Jones (1996) analyse a variety of cases where Lean Thinking principles were implemented. One of the biggest problems individuals and businesses face in going lean is the physical implementation process that needs to be followed. Not many organizations knew how to implement lean. Womack and Jones used their various case studies to describe an action plan for implementing Lean Thinking (Shave, 1998).

3.5.3 GETTING STARTED

Womack and Jones (1996) state that the most difficult step to implementing Lean Thinking is overcoming the current inherent culture in an organisation. A change agent and the core understanding of Lean Thinking is required, as well as a crisis (burning platform) to force the start and drive the change. In addition, a map of the organization's

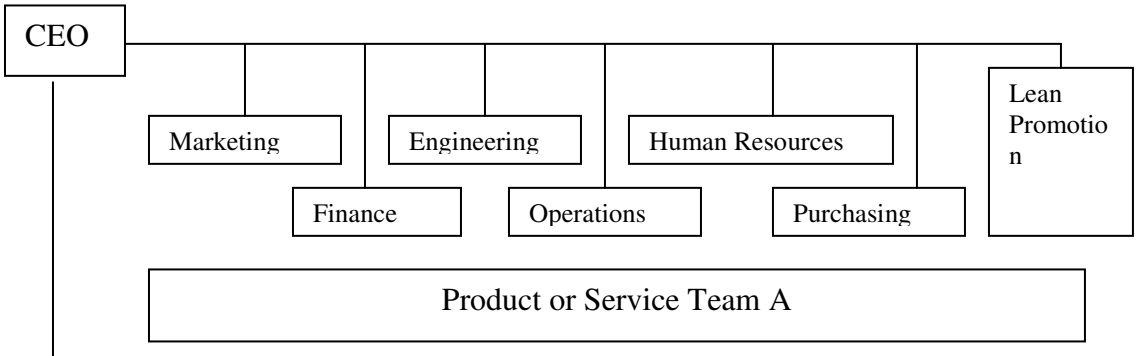
value streams and a determination to rapidly enhance the value creating activities are also required.

The focus of this research, as mentioned above is to map the value stream of the provisioning of textbooks in the ECDoE public schools. According to Womack and Jones (1996), mapping should be the first step in implementing lean. Using this start, the momentum for implementation should be kept up. VSM will help people identify the processes, role players, the value and non-value adding activities and know when and where to start making improvements.

3.5.4 CREATING AN ORGANISATION TO CHANNEL THE STREAMS

After identifying costumer and customer value, the first step is to create an organisation to channel the flow of value and keep the value stream from splitting up into branches. A practical plan will have to be developed to fully utilise all the resources that will have been freed up.

To achieve this, the business must be re-organized by product families with someone in-charge of each product, see chart below. The organisation chart of the lean business should look something like the overleaf (what and where?). Sometimes it requires the creation of a strong lean promotion function that reports directly to the change agent, as well as a consistent approach to employment and a willingness to remove those who will never accept the new techniques. It is important to get rid of the surplus labour and assure the remaining people that no one will lose their jobs on the account of lean implementation (Mishina and Takeda 1995). In addition, a continuous improvement culture must be instilled in the employees; it is better to go forward and make mistakes to learn from, than never to progress at all.



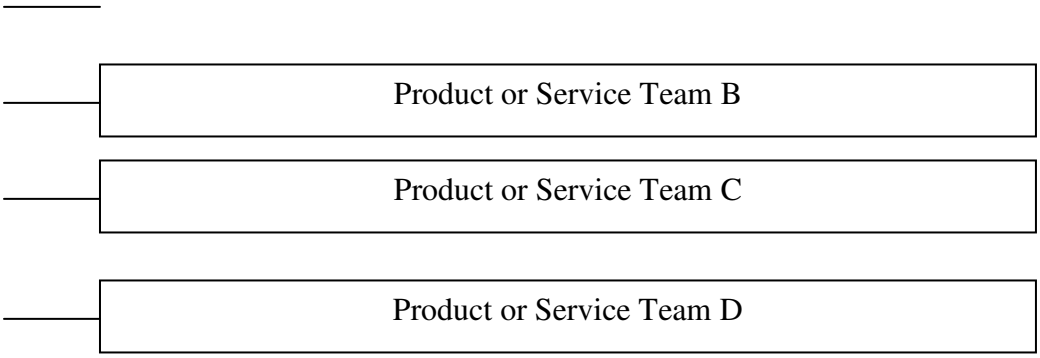


Figure 3: Prototype Lean Organization adapted from Womack and Jones (1996)

3.5.5 ENCOURAGE LEAN THINKING

The time that has been gained in the momentum for the change process and in rethinking the structure of the organization is similar to period that lean transformation can be completed (Rother and Harris 2001). It is paramount to take additional steps to make this new system self-sustaining. In addition to making the system transparent so that everyone can monitor what is happening in the organization, these steps include utilizing a policy deployment to set an agreement that the firm will take on, for example, three to four lean tasks every year, identifying the important tasks that cannot be addressed immediately.

Womack and Jones (1996) point out that people in the organization should be paid in relation to the performance of the organization. This is probably the best incentive scheme the organization can use and still keep the incentive scheme simple. The payment scheme is also an important step to making the new system self-sustaining. In addition, tools should be developed to allow a given product family to move through the value stream without delays and allow rapid change overs and flexibility.

3.5.6 COMPLETING THE TRANSFORMATION

After about three to four years, momentum has been established and organizations are usually moving ahead with the required changes and the organisation is being reconfigured with appropriate business systems in place to complete the transformation

(Womack and Jones, 1996). There are a few final steps required, including convincing suppliers and customers to take the steps so that they become in sync with the firm's offering and production line. The strategy should be developed to reflect a complete design, order-taking and production system within each major market of sale, so that it makes communication with the customers much easier.

3.5.7 IMPLEMENTATION TIMELINE AND COMMITMENT

For any sustainable change, a solid base must be prepared and this takes time, since a large number of people at all levels in the organization need to experiment and become knowledgeable in the lean principles. Womack and Jones claim that the implementation process could take up to five years and this requires a wholehearted commitment from everyone in the organization. Participants in the implementation exercise should understand that it is acceptable to take two steps forward and one step back, because eventually they will see the change take place. At this point, the change agent is no longer required and the organization cannot look back.

3.5.8 PROCESS STABILITY AND LEAN

Despite these triumphs, many firms visited by Womack and Jones were stuck in first gear on their initial lean efforts. They were trying to create flow but could not achieve forward progress. There are many reasons for this lack of progress. Insufficient leadership, resources, or commitment are a few of the most common. But an overlooked and recurring pitfall observed more often is a lack of "basic stability" in manufacturing operations.

When pressed by Womack and Jones, veterans of Toyota commented that certain pre-conditions are needed for lean implementation to proceed smoothly. These include relatively few problems in equipment uptime, available materials with few defects, and strong supervision at the production line level. And these are precisely the problems that manufacturers are still struggling with today (Kahn and Mello, 2004).

In the simplest sense, this implies general predictability and consistent availability in terms of manpower, machines, materials, and methods, the 4Ms. Under each of these basic building blocks of manufacturing, Toyota tries to establish a consistent and predictable process before going too far down the road with the latter elements of flow and takt time.

The reason is simple. Without fundamental items like machine uptime or human resources in place, a production line cannot run and achieve perfect flow or pace to takt time. For example, producing to takt time and achieving perfect flow *assumes* a sufficient level of machine uptime is in place. Rother and Shook (1999) pointed out that takt time can be defined as the maximum time per unit allowed to produce a product in order to meet customer demand. The same is true for the rest of the 4Ms as adopted from Kahn and Mello (2004). How do you know if you have enough stability in operations to proceed with flow? The answer depends upon the ability to meet a few key requirements as follows:

- Do you have enough machine uptime to produce customer demand?
- Do you have enough material on hand every day to meet your production needs?
- Do you have enough trained employees available to handle the current processes?
- Do you have work methods, such as basic work instructions, defined specifications or standards in place?

If the answer is "no" to any of these questions, stop and fix the problem before proceeding. Attempting to flow product exactly to customer demand with an unstable line, untrained employees, poor supervision, or little inventory in place is a recipe for disaster (Kahn and Mello, 2004).

There is no need for perfect uptime in order to meet customer demand (Kahn and Mello, 2004). If, for example, assembly takt time is 60 seconds and the upstream machine process cycle time is 30 seconds then there is only a need for some inventory to act as a buffer and slightly better than 50% uptime to begin establishing a better production flow paced to takt time. The same logic applies to the 4 Ms as well. For instance, if the line needs eight people to run and there is consistently only six people trained to do the job, then there is a basic stability problem. To achieve basic stability, the four key elements corresponding to the 4Ms as adapted from Kahn and Mello (2004) can assist.

Manpower: Basic stability starts with a well trained workforce. However, Toyota in the 1950's learned some basic techniques about supervision in production and how to further improve the skills and capabilities of work teams. Specifically, they adopted an industrial training program that the U.S. used during World War II called Training Within Industry (TWI). It had three specific job training components for production supervisors job instruction, job methods, and job relations. Each component was a ten-hour course that taught practical supervision skills.

Job instruction (JI) taught supervisors how to plan for the correct resources they would need in production, how to break down jobs for instruction, and how to teach people safely, correctly, and conscientiously. Job methods (JM) taught supervisors how to analyze jobs and make simple improvements within their realms of control. Every activity was considered for improvement. Supervisors learned to question why an activity was done this way, and if it could be eliminated, combined with something else, rearranged, or simplified. Job relations (JR) taught supervisor's to treat people as individuals and solve basic human-related problems in production rather than to ignore them.

Taken together these three courses helped supervisors create a basic routine, discipline, and sense of fairness in work teams. Years later, these same TWI courses and fundamental tenants constitute the basis for training supervisors and work teams in Toyota. The personnel working at the DoE have been working in their current portfolios for less than two years (ECDoE, 2007). Thus supply chain management training could be a valuable tool for understanding all stakeholders and stages in the chain of supplying textbook to schools. The appointment of data capturers can be such that only those that are computer literate are employed to shorten the processing time.

Machines: There is no need for equipment with perfect uptime, but the customer demand must be known, the capacity of the process, and the actual average output.

Toyota uses a basic document called the process capacity sheet to measure the true output potential of a process during a typical shift. If there is a theoretical capacity as well as demonstrated capacity to meet customer demand then there is no problem and

only when there is no demonstrated capacity to meet demand that there is basic machine stability problem. For example, if customer demand is 700 units per shift and your actual output is only 500 units despite having the capacity for 1000, then there is a need for more availability.

In cases such as these, Ohno actually had people stand at the problem machine for the entire eight-hour shift and record the production plan versus actual amount in small increments, such as 15 minutes to one hour. At the end of the shift, all the losses and the actual reasons why were identified in a Pareto chart. Simple and quick meetings were convened if necessary and improvement plans put into place.

Materials: In general the goal of lean is to reduce waste and shorten the timeline from when an order is received until the time it is produced. Normally this requires the reduction of inventory in the value stream. If basic instability increases, there might be a need to increase inventory in the short term in some places or in some instances. The reason is because with some processes the production can flow one by one or in very small amounts. For batch processes, however, some amount of inventory is required to cover for the time when other parts are running, or tools are being changed. The amount of inventory that is needed is composed of what Toyota calls cycle stock (the amount of inventory to cover average demand and the lead time to replenish it), buffer stock (inventory to cover variations that might exist in the downstream or customer demand), and safety stock (inventory to cover the losses such as scrap or downtime that you currently have). Failure to account for this necessary buffer and safety stock in an unstable environment will actually harm the production line efficiency.

Toyota has suggested two pieces of advice on inventory. First, not all inventories are waste. Only inventory beyond what is needed to run the process is waste. Second, inventory often exists as a symptom of a problem in the process. Solving the problem earns the right to reduce the inventory. There is no need for the Department to keep stock/inventory because schools order books once a year and these can be printed by publishers based on the order. The books are ordered in batches, the textbook name and number (volume). The publishers are requested to keep 15% of the standard textbooks for mop-up orders, however there is zero inventory in the ECDoE. Thus, the risk (waste) is transferred from the Department to suppliers.

Methods: Finally, achieving basic stability requires having standard methods for manufacturing. The key point here is the definition of a standard. The normal definition is that a standard is a rule or way to do things. The unintentional side effect is that people are not encouraged to question or change the rule. "We do it this way because that is our company standard" is a phrase often used.

The definition of a standard in Toyota is slightly different. A standard is a "rule or a basis for comparison." A standard is nothing more that a tool to measure how the system is doing something and to refer to when there is a need for change. Lean Thinking is about changing work methods in order to eliminate waste and make improvements. The standards are used to measure and compare changes so that it can be clearly established if the new way is better or not (Hines et al, 2004).

3.6 VALUE STREAM MAPPING

Value Stream Mapping (VSM) is a visual aid that describes the various stages in the consumption process (Rother and Shook, 1999). VSM is an effective way to detect waste (*muda*) being generated in a supply chain and hence assist in achieving a lean supply chain (Womack and Jones, 1996).

"The value stream is the set of all the specific actions required to bring a specific product, whether a goods, a service or increasingly a combination of the two to the customer" (Womack and Jones, 1996:19). This can be achieved through the three critical management tasks of any business:

(a) the problem-solving task running from concept through detailed design and engineering to production launch;
(b) the information management task running from order-taking through detailed scheduling to delivery; and
(c) the physical transformation task proceeding from raw materials to a finished product in the hands of the customer.

This research focuses largely on the services provided by the ECDoE, hence will employ and measure mainly the information management task from ordering of textbooks until their delivery to the EC public schools. It should be noted that no physical transformation or problem-solving tasks will be measured in this study.

Womack and Jones (2005:42) propose that "a complete value stream consists of the consumption stream plus the provision stream", where the consumption stream visualizes consumption as experienced by the customer and the provision stream visualizes the activities involved in the provider delivering a product or service to the customer. Liker & Meier (2005:34) suggest that seeing the VSM in reverse, from the customer's perspective, can form the basis for the future desired state VSM by creating "pull" within the process *flow*. Liker and Meier (2005:37) suggest the following tips, which aided the researcher in this study, with regard the use of VSM:

1. The current state VSM can be used as the foundation for the desired future state;
2. The future state map represents what the organisation is attempting to achieve;
3. The future state map facilitation should be performed by a lean expert;
4. The purpose of the VSM is a basis for action;
5. The VSM should be developed at frequent intervals;
6. A senior person should lead the improvement initiatives; and
7. Plan Do Study Act *cycles* should occur on a continuous basis in order to facilitate continuous improvement.

The value-stream perspective represents a shift from traditional vertical thinking to horizontal thinking (Rother and Harris, 2001). This means looking across the silos of individual functions and departments to connect activities in the stream of value flowing from suppliers through the organization, and on to customers. In other words, looking at overall flow, means looking at system efficiency rather than at only the point efficiency of individual elements in an organization. The process of supply is a cross-departmental activity, such as requisitions and ordering take place in LSM unit, book selection by LSM unit, procurement and payment of suppliers from Finance Unit.

To Rother and Shook (1999), a value stream perspective means working on the big picture, not just individual processes, and improving the whole, not just optimizing the parts. If the person responsible for the mapping truly looks at the whole and goes all the way from raw materials to delivery of the product to the customer, there will be a need to follow the value stream for the product across many firms and even more facilities. But mapping this entire stream is too much when getting started.

The workbook *Learning to see* by Rother and Shook (1999) covers the "door-to-door" production flow inside a plant, including shipment to the plant's customer and delivery of supplied parts and materials, where a map can be designed for a future-state vision and implementation can start right away. This is a good level at which to begin the mapping and lean implementation effort, refer to Appendix 4 & 5. This is the same approach that was used to map the process of supply of textbooks in the Department. This research will be limited to the Department and will not cover upstream activities (suppliers).

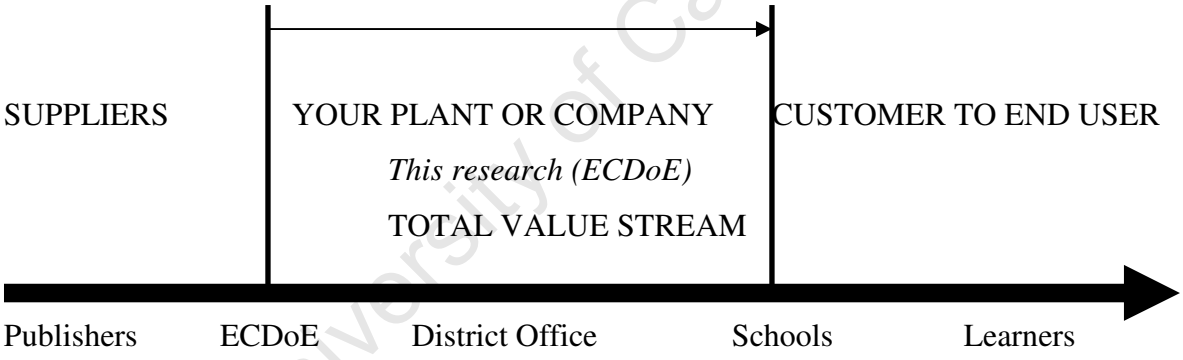


Figure 4: Showing applicable coverage of VSM measure on this research report

3.6.1 WHY VALUE-STREAM MAPPING IS AN ESSENTIAL TOOL

As indicated above, VSM is an effective tool to detect waste (muda) generated in a supply chain and hence assist in achieving a lean supply chain. The current state map developed after collecting relevant information from the ECDoE should lead to the discovery of three types of processes; value adding, non-value adding and non-value adding but necessary. Unnecessary non-value adding processes are muda creating activities and the development of a future-state map should aim to eliminate this *muda*.

Rother and Shook (1999) set out the following reasons why VSM is an essential tool in the identification and elimination of waste:

(a) It helps to visualize more than just the single-process level, i.e. assembly, welding, etc, in production. You can see the flow;

(b) It helps to see more than waste. Mapping helps to see the sources of waste in the value stream;

(c) It provides a common language for talking about manufacturing processes;

(d) It makes decisions about the flow apparent, so they can be discussed. Otherwise, many details and decisions on the shop floor may happen by default;

(e) It ties together lean concepts and a technique which helps to avoid "cherry picking";

(f) It forms the basis of an implementation plan. By helping to design how the whole door-to-door flow should operate

(g) It shows the linkages between information flow and material flow. No other tool does this;

(h) It is much more useful than quantitative tools and layout diagrams that produce a tally of non-value-added steps, lead time, distance travelled, the amount of inventory, and so on; and

(i) Value-stream mapping is a qualitative tool by which to describe in detail how the facility should operate in order to create flow. Numbers are good for creating a sense of urgency or as before/after measures. VSM is good for describing what is being done to affect those numbers.

3.6.2 IMPLEMETATION OF VALUE STREAM MAPPING

VSM is a pencil and paper tool that helps organisations and individuals to see and understand the flow of materials and information as the product makes its way through the value stream (Hines et al 2004). What is meant by VSM is simple: follow a product's production path from customer to supplier, and carefully draw a visual representation of every process in the material and information flow. Then ask a set of key questions and draw a "future-state" map of how value should flow or eliminate waste that has been exposed by current VSM.

As adopted from Rother and Shook (1999), VSM is the same at every level. The people doing the mapping try to capture on one sheet of A3-sized paper (11" x 17") a two-dimensional representation of the material and information flows of the value stream (Rother and Shook, 1999). The objective is to render in simple form that which seems so complex and confusing in real life, so that we can change our focal plane from narrow operational efficiency to total value-stream optimization. Just as with manufacturing facility mapping, first draw a map of each step in the current state from which to devise a future state that can then be implemented right away. The mapping symbols are attached in Appendix 6.

A map for a support function looks much the same as a map for a manufacturing facility or service, with process boxes, data boxes, information flow arrows, and a timeline across the bottom. The biggest difference between support operation and plant mapping is in the distinction between information and material flow, which in manufacturing is very clear. Furthermore, simply drawing the map with these distinctions will almost always lead to numerous surprises with critical questions almost jumping out at the people mapping the plant. Ideas for counter measures or actions that offset continuous flow then flow quite easily. This is especially true since the characteristics of a lean value stream can be articulated quite clearly for manufacturing or service operations.

All these material and information flow issues change when the people doing the mapping leave the plant floor to map support or administrative operations. First, a clear distinction between "material" (or process) flow and information flow often cannot be made; the information moves with the material.

When the information and material move together, the magic of the two-dimensional visual representation of the value-stream map is lost. On the surface, the map becomes little more than a glorified flow chart, or "process map." The relevant factor is, however, just as it is with any tool, the purpose or intent one brings to the use of the tool. Even without the clear information flow arrows descending from above (as with manufacturing facility mapping), creative use of the data boxes, timeline and future-state questions can still lead a mapping team to a new focal plane, new countermeasures, and a viable future state, refer to Appendix 5 for VSM symbols.

The lack of distinction between material and information flows and the fact that the information travels with the work means that it can be very difficult to even draw the top half of the map, which is the information flow. In the plant, the mapping team draws a "production control" or "scheduling" box, from which production instructions flow to each operation, attempting to tell each operator what to do and when to do it. The questions used to identify those information flows range from asking operators or officials in the case of the ECDoE a simple question such as, "How do you know what to do next"? For support functions, even if the information and work seem to flow together, the mapping team should at least try to go through the same process and ask the same questions. This will be very important when working through the future state. Even in the office environment, work is being performed *for some customer*. Who is that customer, what are his or her needs, within what time does he or she require the work? With such questions, administrative or support function mapping teams can try to draw the information flow separately, even if the information is not literally coming from a central scheduling function.

As with drawing the information flow, support operation mapping teams should *try* to go through all the future-state questions. Some of the questions may not seem to fit well with some types of work, but the questions provide a good framework for discussions to better understand the issues and what needs to be done to envision and implement a lean future state:

a) Produce to own takt time

The "takt time" is how often you should produce one part of a product, based on the rate of sales, to meet customers' requirements. The takt time is a reference number that gives a sense for the rate at which a process should be producing; therefore allowing the process person to see how the process is doing and what needs improvement.

Takt time = available working time per day (hours)

Customer demand rate per day (units)

This is a manufacturing or service concept that can easily be translated into how many books in a school need to be delivered over a specific period of time. Acquiring of books is an annual predictable process, however there are minor variations of volumes unless there is a curriculum change which happens at least in 5 year intervals. Therefore, a takt time can be useful to pace the process.

b) Develop continuous flow wherever possible

A lot of creativity should be used in trying to achieve a continuous flow as this is the most efficient way to produce. It requires processing only one piece at a time, which is immediately passed on to the next stage of production without stopping in between. The notion of continuous flow is central to lean thinking. This is where the book or information moves from one step in the process to the next without delay. It is the most efficient way to manage any process as it reduces waste to a minimum.

If you are able to introduce continuous flow, the future map should show the previous process boxes being joined together as one single process box. Separate boxes are only required if each process has its own separate flow sequence which stops before another commences.

Whilst ideal, continuous flow isn't achievable in all situations. This may be because geography separates steps in the journey, or that some parts of the pathway have a very long lead time and are difficult to couple directly to the next stage.

c) Use supermarkets to control production where continuous flow does not extend upstream

It is not always possible to create continuous flow; there are often spots where batching is necessary for various reasons presented by Rother and Shook:

- Some processes are designed to operate at very fast or slow cycle times and need to change over to serve multiple product families;
- Some processes, such as those at suppliers, are far away and shipping one piece at a time is not realistic; and

- Some processes have too much lead time or are too unreliable to couple directly to other processes in a continuous flow.

In planning for a production line or service delivery, a schedule is only an estimate of what the next process will actually need; therefore it is vital to avoid scheduling processes via an independent scheduling function. Rather, it would be better to control them using a supermarket based pull system to link them to their downstream "customers". This means that products being taken off the "shelf" should signal the requirement of "refill" and only then must the process be scheduled. The purpose of developing a pull system is to create a means of sending information upstream for the need for more products, without having to predict the downstream demands. When continuous flow is not possible, the next most efficient type of flow is 'pull' or 'the supermarket pull system'. Pull is where the next part of the process pulls parts from the one before.

The requisitions from schools creates the initial "push" in the system; they stipulate which books are required and quantity. The size of this pull should be large enough to ensure that there is continuous feed, even if there are disruptions in the other processes, but not so large that the information is stalled for a long time. This is a fine balance but, over time, the aim should be to make the pool as small as possible and eventually replace it with a continuous pull system.

This simple system may seem familiar, but all too often there is no relationship between the different processes. This method enables the earlier part of the process to control and regulate the flow. In industry, the cards used to communicate between processes are known as Kanban cards. They are carefully monitoring and coordinating the use and replenishment of parts, tools to orchestrate specific schedules so that the maximum amount of inventory allowed can be calculated.

Another type of flow management system is first-in first-out (FIFO). This system can be used in various activities where continuous flow, push or pull is impossible. It is often used if the process is rare, or if there is a great deal of variation in the cycle time.

Whilst most of times the supply is predictable, there are instances when this can break down due to lack of communication such that the information is delayed. When this happens, it is best to organise the flow according to FIFO which may improve downstream flow, particularly through bottleneck areas. There will be a need to implement some form of queuing to operate FIFO, but this system should help to ensure efficiency along the whole of the parts pathway.

d) Try send customer schedule to only one production process

Since the production process would be based on downstream pull, scheduling is only required at a single point. This is the pacemaker process, because it sets the pace of production for all the upstream processes. The flow rate is determined by the pacemaker. Using pull systems, there will be the need to schedule only one point on the pathway, known as the pacemaker process. If combined with pull techniques, controlling this pull point will dictate the flow of the whole information journey.

The process needs to occur as a continuous flow otherwise there will need to be multiple control sites which will have to be coordinated. Using a pacemaker makes it possible to control the flow using one simple point. This makes scheduling much simpler than trying to co-ordinate many separate processes.

e) Distribute the production of different products evenly over time at the pacemaker process

One of the difficulties with batch production is that if a customer wanted something different it makes it difficult to change over. To avoid this, manufacturers would tend to have a greater finished goods inventory so that they may have in hand what the customer might want. A better way to solve this problem would be to level the product mix by distributing the production of different products evenly over a period of time.

Levelling the flow is perhaps the most difficult concept of Lean Thinking to transfer to a services environment. Used in manufacturing, levelled scheduling is the

operation of a process in the lowest possible common multiple or all process ingredients are in place. This process is flexible and reduces the waste between stages, but it will only work if other aspects of Lean Thinking are in place.

How can this concept be applied to a services industry supplying textbooks in the ECDoE? An easy way would be to use facsimile transmission, which is available in most schools, so that information flow is smooth and direct from the school to the provincial office. Secondly, install electronic communication systems in schools such as e-mail and internet facilities.This will avoid queues in the district offices when there are deadlines. Also all three proposed systems have a feedback mechanism to ensure that the information is properly transmitted. The proposed systems have a utilization rate report so that they can be monitored on the volume throughput. Monitoring volume throughput could make the machine available for other uses or to other people. The pacemaker concept is also equivalent to that of a bottleneck in the Theory of Constraints philosophy (Hines et al.,2004).

f) Create an "initial pull" by releasing and withdrawing small, consistent increments of work at the pacemaker process

Rother and Shook list the following problems of releasing large batches of work to a shop floor process:

- There is no sense of takt time and no "pull" to which the value stream can respond;
- The volume of work performed typically occurs unevenly over time, with peaks and valleys that cause an extra burden on machines, people, and supermarkets;
- The situation becomes difficult to monitor: "Are we behind or ahead?";
- With a large amount of work released to the shop floor, each process in the value stream can shuffle orders. This increases lead times and the need to expedite; and
- Responding to changes in customer requirements becomes very complicated, which can often be seen in very complex information flows in current-state drawings.

The basic problem with a batch-production system is the build-up of surplus inventory or over-production, rather than aligning production to the needs of

downstream "customers", each process in a batch-production system operates as an isolated island, producing and pushing products forward in accordance to schedules provided by Production Control. These materials create *muda* because they are not immediately needed and therefore need to be handled, counted and stored.

As a result of this, defects in production remain hidden until that product is required by the next "customer", by which time it is expensive and hard to trace. In addition, while the value creating time for producing one product may be short, the total time it takes to go through the system is much longer. More than just eliminating the obvious *muda*, it is necessary to reduce the excessively long lead times – the source of the *muda* needs to be eliminated. Overproduction is the most significant source of *muda,* producing more, sooner or faster than is required by the next process. In the case of books supply, all the deliveries to schools are made by publishers and the cost burden of inventory is transferred to these publishers. In case of LSM provision, the supply of books is required once an academic year, in large volumes. This is a consistent period necessity, therefore, the Department can anticipate the order numbers from schools whether for new curriculum, top-up or mop-up.

To avoid or reduce large irregular and unpredictable orders, it is recommended that a consistent or level production pace be established, which will create a predictable production flow that can make problem detection and correction easier. To do this, a small, consistent amount of production instruction should be released regularly at the pacemaker process, and simultaneously an equal amount of finished goods be taken away. Also, implementation of a temporary countermeasure (storerooms) until the system is capable of producing to the customer required time which is the same day the class starts, the books appear. In the case of supply of book, it is also difficult for the Department to forecast accurately the number of learners who will require textbooks because of leaner dropouts, learner repeaters, book damages and books lost. Thus, ordering for subsequent academic year in the beginning of the preceding year may lead to the creation of overproduction and result in wasteful expenditure as some schools indicated lack of storerooms (FFC, 2005).

g) Develop the ability to make "every part every day"

To allow upstream fabrication processes to respond quickly to downstream changes, the changeover time in the upstream process must be reduced by running smaller batches. This would also require fewer inventories to be held in their "super markets". In case of ECDoE, if the personnel can receive and deal with different information almost every day, they will gain experience and this will later enhance their skills for dealing with different aspects of their job and they will also become multi-skilled. Being multi-skilled will assist personnel to work with variety of aspects which can improve decision making skills.

3.7 LEAN CRITICISM

Thus far, the discussions of lean and referenced authors are those who praised Lean Thinking as the perfect tool for increasing business performance. However, nothing is perfect and this holds true for the Lean Thinking concept, as well. Throughout its evolution, various gaps have been recognized by critics within and outside of the lean movement (Hines et al.,2004). Key aspects of this criticism are detailed below, but a summary of the various gaps is provided in Table 7 below, following the key aspects. This section has been adapted largely from Hines et al. (2004).

Table 7: Main gaps and criticisms of Lean Thinking adapted from Hines et al (2004)

Criteria	1980 – 1990	1990 – mid 1990s	Mid 1990 – 2000	2000+
Key gaps	Outside shop-floor Inter-company aspects Systematic thinking Auto assembly	Main automotive Human resources Exploitation of workers Supply chain aspects System dynamics	Coping with variability Integration of processes Inter-company relationship Still mainly auto	Global aspects Understanding customer value Low volume industries Strategic integration

	only	aspects	Integrating industries	E- business
Main critics	Carlisie and Parker (1989) Fucini and Fucini (1990)	William et al. (1992) Garraham and Stewart (1992) Rinehart et al. (1993)	Davidow & Malone (1992) Cusumano (1994) Goldman et al. (1995) Harrison et al. (1999) Suri (1999) Schonberger & Knod (1997)	Bateman (1992) Christopher and Towill (2001) Van Hoek et al. (2001)

3.7.1 LACK OF CONTINGENCY

Hines et al.(2004) state that, even now, there is general confusion regarding the contingent nature required to apply Lean Thinking. Lean Thinking states that the parts inventory must only include those that are to be used in the production line, any part more than required is waste. This poses a risk that, if an unforeseen breakdown occurs or any downstream improvement occurs, then a shortage of parts in a low inventory area might be encountered. For instance, if there is improvement upstream, then downstream processes should cope with that improvement but if the downstream inventory is still aligned to the old process, then delays may occur. Also if there is an unforeseen breakdown, whether a machine or personnel unavailability, lack of buffer stock might threaten the ability to deliver customer's requirement. The lack of buffer stock can lead to delivery delays or complete lack of delivery.

3.7.2 BORDERS OF LEAN

The lean transformation of a supply chain begins at home. The first and often missed step in extending lean beyond the four walls of the main facility is to compartmentalise the facility into one of three areas (as depicted in Figure 4 above) based on the

complexity of the operations and supply chain connection. However, extending lean beyond a factory four walls might be limited because of a legal mandate and/or lack of interest of suppliers or customers in the lean system. In this research, lean philosophy and value stream map will only be employed within the Department of Education. This limits lean's effectiveness in the improvement of the value chain of a product or service.

3.7.3 HUMAN ASPECTS

One of the main criticisms of the Lean Thinking approach is that it could be viewed as exploitative and pressurising for the workers on the shop floor. Authors who have tried to promote such criticism have not been successful in gaining support for their opinions (Hines et al, 2004). However, they have raised the fact that lean should be considered as more than a set of mechanistic hard tools and techniques, and that the human dimensions of motivation, empower and respect for people are very important. The key to lean implementation rests with low level employees (Spear, 2004). This has two implications;

(a) If the company has highly unionised employees there is possibility of sabotage to the production line, thus the impact of a lean system can be less effective. The Department has highly unionised members and this can affect implementation of Lean. However a buy-in from unions and members may be necessary before the system is effected; and

(b) It requires managers to trust lower level (shop-floor) employees. If this trust is questionable, this can undermine the successful implementation of lean

3.7.4 EXPOSE PROBLEMS OR WASTE

Lean Thinking and VSM are intended to expose problem areas in the process. As indicated earlier, at Toyota, if there is a problem in the line, the employee stops the line so it can be solved and not transferred to the next stage of the process. If there is a long history of a punitive approach to problems in an organization or a "blame" or finger pointing style, this style can inhibit employees from exposing problems so that they can

be solved. Most interviewees were uncomfortable about the use of a tape recorder during interviews to avoid political sabotage. One Administrator in the ECDoE commentated that "everything here is highly politicised". Thus exposing problems could be seen as either political or career limiting.

3.7.5 SCOPE AND LACK OF STRATEGIC PERSPECTIVE

Lean Thinking seems to promote discussions of how to apply a range of different tools and techniques. What would be more useful is a medium for discussing strategic level thinking in lean programmes. Thus, the tool does not provide strategic direction but is limited to improving the current operations. Lean management in this study is narrowed to focus on improvement of the process and limited in adequately advising on the strategic direction that ECDoE should take in the provisioning of books, either to keep the status quo, outsource or adopt a hybrid.

3.7.6 COPING WITH VARIABILITY

Hines et al (2004), argue that the ability of lean production systems and supply chains to cope with variability has also been a point of concentration for Lean Thinking critics. They suggest that, while lean approaches seek to find ways to manage variability and to create capacity by utilizing assets more efficiently to add value to customers, they are not very pertinent when dealing with demand variability. Lean approaches tend to flatten or control demand, which is acceptable for the environments in which these approaches originate that is fairly stable demand environment industries, such as automotive, but it can be inflexible for other more variable environments. The supply of books is a monotonous activity that occurs every year, thus a predictable process with less process variation unless there is a change in curriculum or procurement legislation.

3.8 CONCLUSIONS

There is little doubt that the Toyota Production System (TPS) and its American derivative Lean Thinking is the most dominant improvement program of our time (Spear and Bowen (1999). Unlike other management fads that have come and gone, TPS has been honed and steadily improved since the early 1950's in Japan.

The first place to begin any re-assessment is typically to draw a value-stream map of the entire customer order to delivery process across the company. However, in this case, the process was measured where direct influence by the Department can be exerted. Thus, VSM was only drawn for activities in the ECDoE which include Head office, district offices and schools. For the present study, Lean Thinking was employed to assess the process of provisioning of textbooks to illustrate the following:

(a) Clarify the steps in the process by VSM;
(b) Identify non-value add activities;
(c) Apply 5 Lean Thinking principles to assess the process effectiveness; and
(d) Suggest improvements as measured by the reduced time for the process.

The current-state VSM was drawn for this study to show the current areas where muda exist and future-state VSM done to reflect on the improvements, refer Appendix 4 and 5. The identified waste will be classified according to the eight categories of waste and discussed in detail in Chapter 5.

CHAPTER 4 - RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter serves a dual purpose, it presents the research design (approach and framework), which guided the methodology (execution) of this study. The chapter deals with the methods that were used to generate data in an attempt to answer the research questions and achieve the research goals. According to Babbie and Mouton (2003), there is logic to the process of research. Yin (2003) goes on to state that the research design is the "blueprint" of the research detailing at least four issues, namely what question to study, what data is deemed relevant, what data to collect and how the data is to be analysed.

At the methodological level, the researcher chooses techniques of investigation and, according to Denzin and Lincoln (1994), these are hermeneutical (interpretive), dialectical, or as stated phenomenological, ethno-methodological or symbolic interactional. All these methodologies emphasize that, through interpretation or debate, the researcher is able to construct a transient truth of the phenomenon being observed.

As stated in chapter 1, the Eastern Cape Department of Education (ECDoE) has been mandated to deliver democratic and egalitarian education to its citizens. The ECDoE embarked on decentralizing the education system in 1999 to improve its financial efficiency and to bring services closer to the people (Cole, 1999). Thus, the primary objective of the empirical research is to gather factual information that seeks to determine the effectiveness of the process of provisioning of textbooks in the Eastern Cape. Further, this study attempts to measure the implemented policies in the supply of textbooks and its effect to schools. In this chapter, the empirical part of the study will be outlined, covering the research design, the description of the research methodology and its rationale, trustworthiness and ethical considerations during data collection, synthesis and reporting.

Henle (cited in Chadwick, 1984) argues that there are five ways in which knowledge of the World can be gained - scientific, philosophical, mathematical, theological and humanistic. This chapter describes how this research was undertaken within the scientific realm of

knowledge development. When undertaking research, Remenyi (1996: 22) argued that there are "three major philosophical questions" that should be addressed at the outset of the research. These three philosophical questions underpinning any research within the scientific way of knowing are:

(a) Why research?;

(b) What to research?; and

(c) How to research?

The why and what questions have been addressed in the preceding chapters. To evaluate "how" this research has contributed to the already existing body of knowledge, an account of the path taken to reach the documented outcome are detailed in this chapter. The 'how' part of the research must be stated and this chapter gives a detailed analysis of how the research was conducted.

4.2 RESEARCH QUESTIONS

The study aims at informing the policy makers in the Eastern Cape education department about the quality of the service delivery regarding the supply of textbooks to public schools. The ECDoE Administrators at Head Office and District Offices were approached as they deal with policy formulation and the execution of provisioning of textbooks. Secondary public schools with Grade 12 were considered for this study as their outcomes can be easily measured and are published annually. The primary research questions and hypotheses include:

Q1: How does the implemented policy for delivery and supply of textbooks to schools by the ECDoE assist in the efficiency of the supply?

Q2: How can Value Stream Mapping (VSM) be used to describe the process of supplying textbooks in the ECDoE public schools?

Q3: How can VSM be applied to expedite the material and information flow between the role players, namely Administrators at the Head Office (Zwelitsha), District Offices and schools in the supply and distribution of textbooks?

Q4: How can VSM be used to identify non-value adding activities (waste) and, based on the findings recommend improvements?

Q5: How can the application of Lean Thinking principles, philosophies and tools contribute to the improvement in the supply of textbooks to EC public schools, as measured by reduced time in the system?

The success or failure of the service delivery such as provisioning of books to schools by the ECDoE is ultimately assessed by the quality of the learners through the pass rate at Grade 12. Hence to support the primary questions above, the sub-problems that link the supply of textbooks and the Grade 12 pass rate have been developed through these hypotheses:

H1: An increase in the number of learners without textbooks has negative impact on the Grade 12 pass rate;

H2: A decrease in the time (measured in weeks) that schools take to return the requisition forms to district offices for textbooks can improve Grade 12 pass rate;

H3: An increase in the time taken (measured in months) to deliver textbooks to the schools has an adverse impact on Grade 12 pass rate.

The research design and methodology were guided by the questions above so that they are adequately answered. The research strategy followed during this research is, in the ECDoE context, from Head office through to school level. The research strategy is ideographic because the researcher emphasizes the distinctive nature of service delivery to schools by the ECDoE which involves Administrators in the Head Office and Districts and schools through the utilization of appropriate research techniques.

The assumptions directing this specific research are also part of the orientation needed to form an idea of the school of thought the researcher implemented in the research process and will therefore be discussed below.

4.3 RESEARCH DESIGN

Welman and Kruger (1999: 46) explain a research design as the plan according to which researchers use research participants and collect information from them. The research design

reflects the type of study undertaken to provide acceptable answers to the research problem (Mouton, 2001). According to Kerlinger and Lee (2000) research design has two basic purposes, a) to provide answers to research questions and b) to control error variance.
Research designs are required to enable the researcher to answer research questions as, objectively, accurately, and economically as possible.

The research design is said to be different to that of the research methodology. The research design focuses on the logic of the research, and according to Babbie and Mouton (2003: 647) is the "structured framework of how you intend conducting the research process in order to solve the research problem". A research design describes a flexible set of guidelines that connect theoretical paradigms to strategies of inquiry and methods of collecting empirical material (Denzin and Lincoln, 1994). As a plan for assembling, organizing and integrating factual information (data), it can be compared to an architectural blueprint, one that results in a specific end product, research findings (Merriam, 1991). It involves putting data together and bringing to consciousness as many aspects as possible of the researcher's planning and preparations for inquiry (Le Compte and Preissle, 1993).

The selection of a particular design is determined by how the problem is shaped, by the questions it raises, and by the type of end product desired. The research is also interpretive, in the sense that it seeks to understand and interpret reality, rather than to capture it positivistically (Flick, 1998). The outcome of this research will thus reflect the reality of the effectiveness of policies and the reduced time for the supply and distribution of textbooks to schools within the Eastern Cape. The applicable research design and its rationale is discussed below.

4.3.1 EX POST FACTO RESEARCH VERSUS EXPERIMENTAL RESEARCH

According to Cooper and Emory (1995) and Kerlinger and Lee (2000), *ex post facto* research is a systematic empirical inquiry in which the researcher does not have direct control of independent variables in the sense of being able to manipulate them, because their manifestations have already occurred or because they are inherently not amenable to manipulation. Inferences about relationships between variables are made, without direct

intervention, from concomitant variations of independent and dependant variables. Kerlinger and Lee (2000) contrasted *ex post facto* research with experimental research and found that it would be unwarranted to conclude that *ex post facto* research is inferior to experimental research, especially in the social sciences context. It is easy to say that *ex post facto* research is merely correlations. However, such a statement would be an oversimplification. What is rather needed is a balanced understanding of the strengths and weaknesses of both kinds of research. Cooper and Emory (1995) and Kerlinger and Lee (2000) highlight that *ex post facto* research has three major weaknesses:

(a) The inability to manipulate independent variables;
(b) The lack of power to randomise; and
(c) The risk of improper interpretation.

In comparison to experimental research, *ex post facto* research lacks control; this lack is the basis of the third weakness, the risk of improper interpretation. The danger of improper and erroneous interpretations in *ex post facto* research comes in part from the plausibility of many explanations of complex events. However, when guided by proper hypotheses, the results of such studies are more valid.

According to Kerlinger and Lee (2000), despite the weaknesses, much *ex post facto* research is done in the social sciences because many research problems in the social sciences do not lend themselves to experimental inquiry. Many of the research problems in the social sciences lend themselves to controlled inquiry of the *ex post facto* kind, which is also true for this study. This study is interested in the past events. The provisioning of LSM policy and processes were instituted in 2003 and therefore this study attempts to measure if this policy and the derivative processes have been effective in improving the supply of textbooks to schools.

4.4 RESEARCH PARADIGM

To ensure a proper research design and an appropriate methodology for the research, an understanding of the term "paradigm" is needed. Lincoln and Guba (1985: 25) describes a paradigm as " much more than a model or pattern; it is a view of the world that reflects our most basic beliefs and assumptions about the human condition". Denzin and Lincoln (1998:

157) in a further refinement explain a research paradigm as "a basic set of beliefs that guide action", dealing with first principles, 'ultimates' or the researcher's worldviews.

There have been many debates about the quantitative and qualitative paradigms which are used to indicate different approaches to the investigation of research questions. Distinctions between qualitative and quantitative research are firmly entrenched in a number of social science studies. These have different philosophical premises, and epistemological roots that must be understood, respected and maintained for credible and sound research outcomes (Morse, 1994). The research issue determines which approach to research will be used. The one approach is not necessarily superior to the other one and a researcher can even combine the two (Strauss & Corbin, 1990: 18). The characteristics of paradigm are discussed in an attempt to demonstrate the suitability thereof for this study.

4.4.1 THE PURPOSE OF QUANTITATIVE RESEARCH

According to Charles (1992), in empirical research, data are obtained in the form of scores, which can be presented in tabular or graphical form and then analyzed. The purpose of quantitative research is to make objective descriptions using numerical numbers of a limited set of certain interventions. Thus, initial quantitative studies of a research problem typically involve a precise description of the phenomena and a search for pertinent variables and their interrelationships. Ultimately, a theory is formulated to account for the empirical findings (Borg, Gall and Gall, 1993). According to Mokone (1999) and de Vos (1998), when using deductive reasoning the researcher moves from general kinds of statements to particular ones. In its use of deductive reasoning, quantitative research starts with a hypothesis. The statistical hypothesis that can be used here postulates the opposite of what the researcher expects. This is called the null hypothesis (Mokone, 1999:26), however in this case an alternate or research hypothesis which illustrates the direct statistical significance of the variables was used. As such, deductive reasoning requires a nomothetic (scientific) approach to research evidence. "The generalizations or theories that come out of a piece of research must be applicable to a large number of cases or situations" (Dzvimbo, 1995:13). It would mean placing the theory at the beginning of the study with the objective of verifying the theory, rather than developing it.

According to Borg et al (1993) "quantitative researchers make the assumption that they can discover "laws" that lead to reliable prediction and control of educational phenomena. They view their task as the discovery of these laws by searching for irregularities in the behaviour of samples of individuals. This search is aided by statistical analysis, which reveals trends in the sample's behaviour".

Quantitative researchers believe that such trends allow for perfect prediction or control. It is essential for the quantitative researcher to be totally objective when collecting data and analysing the process. Cresswell (1994) describes quantitative research as value-free, formal and unbiased.

Quantitative research involves questionnaires and instruments that can be used in order to measure objectivity. An important strength of quantitative research is that reliability is much easier to establish and cannot be affected by the biases of the researcher, observer or interviewer. Eichelberger (1989:101) mentions that empirical research deals with data that are numerical and is concerned with quantity. Such quantitative data must conform to some level of accuracy and the methods used must be capable of achieving this (Hague and Jackson, 1996). The quantitative research for this study was done to assess the effect of the supply and distribution of textbooks to schools as measured by the learner pass rate. As indicated, the survey was distributed to High Schools with Grade 12. The Grade 12 pass rate was chosen based on the following:

(a) External examiner which minimises bias towards the individual school;
(b) Can work as a proxy for learner quality as the final examinations are standardized throughout South Africa;
(c) The ultimate measure of the success or failure of learners and schools;
(d) It is proxy used to measure learners who want or ready to progress beyond school level; and
(e) Results are published in the public media annually and are thus easily accessible.

The research hypotheses will therefore be tested using statistical techniques. The hypotheses to test the impact of the supply of textbooks on the pass rate of schools are:

H1: An increase in the number of learners without textbooks has negative impact on the Grade 12 pass rate;

H2: A decrease in the time (measured in weeks) that schools take to return the requisition forms to district offices for textbooks can improve Grade 12 pass rate;

H3: An increase in the time taken (measured in months) to deliver textbooks to the schools has an adverse impact on Grade 12 pass rate.

The questions were prepared by the researcher and approved by the Supervisor before being sent to schools, refer to Appendix 2. Having looked at the quantitative research method, the researcher will now look at the qualitative method of research.

4.4.2 THE PURPOSE OF QUALITATIVE RESEARCH

Qualitative research involves the use of qualitative data, such as interviews and questionnaires, documents and texts, and participant observation data, and the researcher's impressions and reactions towards the understanding and explanation of social phenomena. The approach indicates that 'quality' is essential to the nature of things, as opposed to 'quantity' (Neuman, 1994). The qualitative researcher's point of departure is that the phenomenon should manifest itself as it appears naturally and that the researcher would register, record and attempt to understand it (Mouton and Marias, 1990). This view is supported by Creswell (1994) who defines a qualitative study as an "inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting". This, however, does not imply that quality is only inherent in one research paradigm.

Qualitative studies, if not conducted rigorously, could be of poor quality (Gliner, 1994). Qualitative studies are not inferior by definition and the research question determines the method to be used. Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context is largely lost when textual data are quantified. Although most researchers do either quantitative or qualitative research work, some researchers have suggested combining one or more research methods in the one study (Gable, 1994; Kaplan and Duchon, 1988). The advantages of qualitative research are:

(a) There is depth and detail. There may not be as much depth in a standardized questionnaire;
(b) There is openness. New theories can be generated and phenomena ignored by most or all previous researchers and literature can be recognised;
(c) It helps people to see the worldview of their studies; their own categories are used rather than imposing categories; it simulates their experience of the world; and
(d) It attempts to avoid pre-judgments. The goal is to try to capture what is happening without being judgmental; present people on their own terms, try to represent them from their perspectives so that the reader can see their views.

The qualitative paradigm was chosen since it enables a researcher to obtain a holistic picture of the phenomenon to be studied, within its educational context (Miles and Huberman, 1994). The qualitative researcher attempts to capture data on the perceptions of local actors 'from the inside' through a process of deep attentiveness, of empathic understanding, and of suspending or 'bracketing' preconceptions about the topic. The researcher thus attempts to ascertain the essence and fundamental substance of the phenomenon in order to gain a deep understanding (Mouton and Marais, 1990).

Another highlight about qualitative research is on the ways people in particular settings come to understand and take action in their everyday, real life situations (Silverman, 1993).

Marshall and Rossman (1989) emphasise that qualitative research "entails immersion in the everyday life of the setting chosen for study, values participants' perspectives of their world and seeks to discover those perspectives – it is primarily descriptive and relies on the people's world as the primary data". The "thick descriptions" that emanate from detailed observation are not always reported in non-ethnographic studies, but do play a role in the interpretation of all data. A frequently noted attribute of qualitative data is thus their "richness and holism, with strong potential for revealing complexity" (Miles and Huberman 1994).

By developing a focus for data collection, the research is not approached with narrow questions but is concerned with process, rather than just outcome (Merriam and

Simpson, 2000). Erickson (1986:140) lists four types of problems which occur because of poor procedures in qualitative research, namely:

(i) an inadequate amount of evidence,
(ii) inadequate varieties of kinds of evidence,
(iii) inadequate attention to contrary evidence and
(iv) lack of attention to discrepant cases.

Another typical problem that arises in qualitative research is that a researcher may claim to work interpretively and qualitatively, but may do so in a reductionist fashion that gives rise to positivistic qualitative research (Henning, 2004). He further points out that some "qualitative researchers" work with data in a "masked positivist" way. However, qualitative interpretation and understanding imply that the researcher is a constructor of the research findings, interpreting the data from the very first step of coding and using semantic units of meaning that are contextually and pragmatically valid.

In the light of the above, the present study has a qualitative portion in that it seeks to obtain insight into the experiences of:

(i) School principals or LSM coordinators that receive, fill and return order requisitions back to district offices;
(ii) School principals or LSM coordinators that experience the delay or arrival of books in their schools premises;
(iii) ECDoE Administrators who deal with crafting the policy of textbook supply, annual orders, procurement of service providers (publishers) and data capturing; and
(iv) District Office Administrators who receive and distribute order requisitions to and from schools. They also receive and distribute proof of delivery from schools to ECDoE.

"The laboratory of qualitative research is everyday life and cannot be contained in a test tube, started, stopped, manipulated or washed down the sink" (Morse, 1994: 1). Qualitative researchers examine the constraints of everyday life and become involved with the phenomenon (Mouton and Marais, 1990; Denzin and Lincoln, 1998). Mouton and Marais (1990:12) add further that individual researchers "hold explicit beliefs". Wallen and Fraenkel (1997) cite the major characteristic of qualitative research as being

its ability to generate detailed data with rich descriptions of what is being studied. The qualitative research is in-depth and tends to rely on direct quotations reflecting people's personal perspectives and experiences (Denzin and Lincoln, 1998: 11). This follows an inductive explicit approach where important categories, dimensions and interrelationships emerge from the data, including their intensity or frequency. Qualitative researchers think they can capture the individual's point of view more closely through detailed engagement.

Finally, qualitative research recognises that the research process impacts on the research situation (Cassell and Symon, 1994; Denzin and Lincoln, 1998). Winegardner (2004) suggests a qualitative approach is more appropriate when the goal of the researcher is to develop a theory to explain the data through a process of inductive reasoning, as opposed to the researcher whose aim is to locate data and then match it to theory through a process of deductive reasoning. The qualitative method for this study is justified to obtain information regarding the process of provision of textbooks and how this is impacted upon by the established policies. The questions were prepared by the researcher and approved by the Supervisor, refer to Appendix 1.

4.4.3 THE USE OF SECONDARY DATA VERSUS PRIMARY DATA

In this study, the existing descriptive and numerical secondary data were analysed following a literature review. The information was gathered largely from the ECDoE, PSAM and PASA. A review of the literature reveals that the use of secondary data, presents some unique challenges. Secondary data has advantages as well as disadvantages. It is important to note the advantages and disadvantages to ensure that the research will comply with the objectives of the study (Cooper and Emory, 1995). The following advantages of using secondary data were found in the literature:

(a) The use of secondary data saves the time and money (Cooper and Emory, 1995; Saunders, Lewis and Thornhill, 1997);

(b) Secondary data could have higher quality than when new data are collected (Steward and Kamins, as cited by Saunders et al., 1997);

(c) The use of secondary data provides an unobtrusive measure, seeing that the data have already being collected (Robson, as cited in Saunders et al., 1997); and

(d) The re-analysis of secondary data could lead to unexpected and unforeseen new findings (Saunders et al., 1997).

Some of the disadvantages of using secondary data are:

a. Unmeasured variables that relate to the dependable variable can mean that the different sources of variance are uncontrolled. This will diminish the value of the research (Kervin, 1992);
b. False and lost relationships are a further problem of the use of secondary data. Research findings can be queried if all potentially important variables are not measured (Kervin, 1992);
c. Certain measures will not be congruent with a specific concept because the data were collected for another purpose (Kervin, 1992). Accessibility to secondary data could be a problem (Saunders et al., 1997); and
d. The research question would probably be answered only partially, because the data was originally collected for a particular purpose, which may not fit the research question of the current research (Cooper and Emory, 1995; Saunders et al., 1997).

As far as this research is concerned, none of the above disadvantages of using secondary data poses any significant problem or opportunity for error. In all cases where the data were collected, the objective was always the same, that is to measure the process of provisioning of textbooks to schools that exist within a decentralized education system in the Eastern Cape.

4.5 RESEARCH METHODOLOGY

"Methodology is defined as a research model employed by a researcher in a particular project and within the framework of a particular context" (Sarantakos,1997:33). Sarantakos (1997) states that every investigation has a distinct methodology, and one researcher might choose differing methodologies from study to study. A research methodology is merely an operational framework and techniques in which data are collected and placed in order to give them meaning (Leedy, 1993). Although methods are methodological, it is the underlying

methodology that dictates the content, structure and process of a research project (Sarantakos, 1997).

The research methodology has a different focus and is concerned with the steps, procedures, techniques, instruments employed and specific tasks to be followed by the researcher to implement the research design (Mouton, 2001). McMillan *et al.* (2001) argue that all research methodology rests upon a bedrock axiom: the nature of the data and the problem for research dictate the research methodology. All data, all factual information, all knowledge must ultimately reach the researcher either as words or numbers. Triangulation is a compatibility procedure, designed to reconcile the two major methodologies by eclectically using elements from each of the major methodologies to contribute to the solution of the problem.

The methods include firstly the role of the researcher, as the researcher is an integral part of the research process. Secondly, although this study used both qualitative and quantitative methods, the work was primarily based on qualitative methodology through semi-structured interviews with ECDoE Administrators. A quantitative method such as the schools' survey was employed to test the effects of the process of provisioning of textbooks at school level.

Research methodology for this study included sampling, selection of participants, collection and administering of data, tools to analyse gathered factual information, trustworthiness of the methodology and ethical considerations.

4.5.1 SAMPLING

Sampling refers to the choice that the researcher needs to make about whom to approach as informants for the study. Samples in qualitative methods tend to be smaller than with quantitative studies Hancock (2002). In this qualitative study, the sample was not selected to be numerically representative. Therefore, it would be misleading to report relative frequencies (Pope et al., 1999). Through purposeful sampling, information-rich cases were selected for in-depth study. Interviews were continued until a saturation point had been reached and no new categories were received through the data (Pope et al., 1999).

De Vos (1988:191) quotes the definition of sampling given by Arkava and Lane (1983) as "the element of the population considered for actual inclusion in the study". The term refers to strategies that enable us to pick a sub-group as a basis for making inferences about the larger group (Vockell and Asher, 1995). In most cases, it is not possible, due to time and cost considerations, to investigate the entire population hence researchers frequently use samples.

4.5.2 SAMPLING METHOD

There is an interesting debate in the literature about the issue of the minimum size of a sample and representation of the population. Schaller (1992) argues that the larger the population, the larger the sample needs to be. Huysamen (1993) maintains that the size of a sample is determined by the relative homogeneity or heterogeneity of the population and the desired degree of reliability for the purposes of the investigation. Singleton, Straits and McAllister (1998) indicate that factors which influence the size of a sample include heterogeneity of the population, the desired degree of accuracy, the type of a sample, the available resources and the number of variables in which the data is grouped. Luborsky and Rubinstein's view (1995) summarises the matter emphatically, that the basic questions "concern what to observe and how many observations or cases are needed to assure that the findings will contribute useful information".

The study focused only on the personnel that are directly involved in the supply chain of provisioning of textbooks to schools, refer to Table 8 below. The relation between sampling and explanation was iterative and theoretically led. In addition to the practical and theoretical relevance, the emerging qualitative and quantitative research required that the collected data be rich in description and numerical data. It is the richness of data that is the real determinant in selecting the participants as stated quite clearly in the following quote: "Validity, meaningfulness and insights generated from qualitative inquiry have more to do with the information-richness and the observational/analytical capabilities of the researcher than with the sample size" (Patton, 1990:185). According to Saunders et al (1997), the sampling techniques available are divided into two: Probability or representative sampling and Non-probability or judgmental sampling.

The design of the questionnaire in its differing statistical and economic efficiencies has an effect on the size of the sample and since the sample can never reflect its population for certain, the researcher must determine how much precision they need (Cooper and Emory 1995).

4.5.3 SAMPLE SIZE

The decision on a sample size for qualitative inquiry can be even more difficult than for a quantitative inquiry, because there are no definite rules. Sampling depends on the purpose of the inquiry (Neuman, 2003). Studying to gain in-depth understanding could require a smaller sample size, whereas studying the breadth of a phenomenon could require a bigger sample size. The validity, meaningfulness, and insights generated from a qualitative inquiry have more to do with information-richness of the participants selected and the analytical capabilities of the researcher than with the sample size. According to Neuman (2003) sample size is dependent on three aspects:

(a) Degree of accuracy required;
(b) Degree of variability/diversity in the population; and
(c) Number of different variables examined simultaneously in data analysis.

This study embarked on two streams of research paradigms both quantitative and qualitative. The information to test the effectiveness of the process of the supply of textbooks to schools in a decentralized education system was collected from 15 ECDoE Administrators through semi-structured interviews. These interview sessions were used to gather information about the process, policy and practices of supply and distribution of textbooks to schools in the Eastern Cape. For the quantitative method, the survey questionnaire was used to test the effect of the supply and distribution of textbooks to learning and teaching at school level. Consultation with the researcher's promoter was done for questions in the questionnaire and interviews. The statistical analysis in chapter 5 was used to ensure that sample size is suitable in this study.

4.5.4 PROBABILITY OR PURPOSIVE SAMPLING

According to Saunders (1997) each case being selected from the population is known and usually equal for all cases. This means that it is possible to answer research questions and achieve objectives which require the researcher to estimate statistically the characteristics of the population from the sample. As a consequence, probability sampling is often associated with surveys and to a lesser extent experimental research. The process of probability of sampling can be divided into four stages:

(a) Identify a suitable sampling frame based on the research question or objective. The complete list of all cases in the population from which the sample is drawn from was drawn. From a complete list of all public secondary schools in the Province, a sample of the schools was randomly selected. The 2007 information ECDoE address list was used;

(b) Decide on a suitable sample size. Generalization about populations from data collected using any sample is based on probability. The larger the sample, the less likely the error in generalization to the population;

(c) Select the most appropriate sampling technique and select the sample; and

(d) Check that the sample is representative of the population.

These will impact on the overall sample size. In such instances, the Economist's (1993) advice of a minimum number of 30 for statistical analyses provides a useful rule of thumb for the smallest number in each category within the overall sample.

Mouton (1996) noted that many researchers normally work to a 95% level of certainty as the case may be for this study. This means that if the sample was selected 100 times at least 95 of the sample would be certain to represent the characteristics of the population. The margin of error describes the precision of your estimates of the population.

For most business and management research, researchers are content to estimate the population's characteristics to within plus or minus 3 to 5 %t of its true values. This means that if 45% of your sample is in a certain category then your estimate for the total population within the same category will be 45 % plus or minus the margin of error; somewhere between 42 and 48 % for a 3 % margin of error. Non-response is due to three interrelated problems:

1. Refusal to respond;
2. Ineligibility to respond; and
3. Non-contact.

The most common reason for non-response is that the respondent refuses to answer a question or be involved in the research but does not give a reason. 80 public secondary schools were sent questionnaires by e-mail or facsimile and only 30 responded which is a 37% response rate. The 30 respondents represent the targeted types of schools such as Township (formerly Blacks only), Suburban (formerly Whites only) and rural which is a mixture of Whites and formerly Blacks and formerly Whites only schools. The 80 schools were chosen at random from those whose addresses appear on the ECDoE address list. Secondary Schools are schools that offer education from Grade 8 through to Grade 12, bridging both the General Education and Training and Further Education and Training bands (DoE, 1996).

Simple random sampling involves selecting the sample at random from the sampling frame using either random number tables or a computer. To do this, number each of the cases in your sampling frame with a unique number. The first case is numbered 0, the second 1 and so on.

Stratified random sampling is a modification of random sampling in which there is division of the population into two or more relevant and significant strata based on one or a number of attributes. In this study, a stratified random sample of public high schools was chosen from the ECDoE school address register to determine the effects of supply of textbooks to education delivery. This was also dependent on the availability of the School address in the ECDoE school address register.

The subjects were selected because they had specific characteristics, such as expert sampling (Hancock, 2002). Theoretical sampling can be supported by purposive sampling, which increased the diversity of the sample when searching for different properties as supported by Dick (2002) and Patton (1990: 20) who stated clearly that "for these reasons the qualitative researcher will use purposive sampling methods by

identifying access points (settings where subjects could be more easily reached) and selecting especially informative subjects". The purposive sampling method for qualitative research was used as there is only person who is responsible for activities in the supply chain. For instance, there is one LSM Programme Manager in the ECDoE who is responsible for the supply of textbooks in the Province, there is one supply chain manger who deals with procurement of service providers, there is one Director for financial budget. Thus, the sampling was limited to the persons responsible for particular activities.

4.5.5 NON-PROBABILITY OR JUDGMENTAL SAMPLING:

Each case being selected from the total population is not known, and it is impossible to answer research questions or objectives that require statistical inference about the characteristics of the population Saunders (1997).

In the case of qualitative research, sampling can be done in various ways, with purposive sampling probably being the most generally used mode of selecting a group of people and their artifacts (Neuman, 2000). From the discussion thus far, the most appropriate position is that of Kerlinger (1986), who posits that purposeful representativeness is a very important aspect of sampling and requires close attention.

For this study, the qualitative information was gathered from ECDoE Administrators for decentralization and for the process of supply of textbooks. The supporting data to evaluate the effects of textbooks provisioning was obtained through surveys of public schools.

The qualitative data was not drawn randomly, because purposive selection may not be achieved with random sampling in a relatively small and heterogeneous population. Qualitative studies are not designed to be representative in terms of how far they may be generalised statistically and may gain little from an expanded sample size except producing a more cumbersome dataset. The nature and size of the sample were directed by the research question and analytic requirements as supported by Glaser (2002), Pope, Ziebland and Mays (1999) and Patton (1990). The schools surveyed to gather quantitative data were determined through stratified random sampling with schools

whose addresses are available in the ECDoE Schools address list. Therefore, there was little non-probability or judgmental sampling for this study.

4.5.6 SELECTION OF PARTICIPANTS

Selection of participants should consider the time required to get their input and the need to be economical. The data collection methods, target individuals, reasons for their selection and the selection criteria, where all considered in the selection of participants of this study, refer to Table 8 below.

Table 8: Showing data collection participants

Organization	Position	Type of research	Expected information	Date
ECDoE	DDG – Education Operations	Semi-structured Interview	Decentralization and LSM policies	March 2007
ECDoE	Chief Director – Cluster C	Semi-structured Interview	Decentralization and LSM implementation	March 2007
ECDoE	Chief Director – Cluster B	Semi-structured Interview	Decentralization and LSM implementation	July 2007
ECDoE	Director – Supply Chain Management	Semi-structured Interview	LSM procurement	April 2007
ECDoE	Director – Budget	Semi-structured Interview	LSM school financing	April 2007
ECDoE	LSM Officer	Semi-structured Interview	LSM implementation	March 2007
ECDoE	Programme Manager – LSM	Semi-structured Interview	LSM policy and implementation	January 2008
ECDoE	Executive Assistant	Semi-structured	Organizational	March

		Interview	culture and decentralization	2007
District Office	Deputy District Director	Semi-structured Interview	Decentralization	February 2007
District Office	LSM Officer	Semi-structured interview	LSM supply	April 2007
PASA	Manager: Eastern Cape	Semi-structured interview	LSM supply	January 2008
30 EC Public High Schools	Principals or LSM coordinators	Semi-structured Interview	LSM effects on education	2007&8
DoE, PSAM,	Public available information	Literature Review	Emails, Reports, Internet, Books and Journals	2006 - 2008

4.5.7 QUANTITATIVE DATA COLLECTION – SCHOOL SURVEY

The design of the quantitative investigation is a structured questionnaire consisting of closed-ended questions. The questionnaire consisted of 25 questions with 19 being LSM focused. The first part of the questions were intended to provide demographic information, the second portion to elicit perceptions of schools regarding LSM provisioning by the DoE and its effects at school level and the third to reflect problem areas, refer to Appendix 2. The questionnaire was sent to 80 secondary schools through facsimile and only 30 responded. The selected secondary schools with Grade 12 were chosen randomly as their contact details (facsimile number) were available from the ECDoE address list. Questions were formulated around the following constructs:

(i) School demographics including location of the school, pass rate and type of school;

(ii) School experience of the impact of the shortage of textbooks to learning and teaching; and

(iii) Identification of problem areas in the supply of textbooks and suggestion of areas needing improvements.

Questionnaires have become useful as an often-used means of collecting information. Responses are presented in writing, whereas in interviews they are oral. According to Seliger and Shohang (1989), questionnaires have a number of advantages:

(i) They are self -administered and can be given to large groups of the respondents at the same time. Therefore, they are less expensive to administer than other procedures, such as interviews;

(ii) When anonymity is assured, respondents tend to share information of a sensitive nature easily;

(iii) Since the same questionnaire is given to all respondents, data will be of a uniform standard and reliability can be established; and

(iv) Since they are usually given to all respondents at the same time, the data would be accurate. This contributes to validity.

The above view is supported by Mason and Bramble (1990:300), who state that questionnaires offer advantages over interviews as a larger sample can be reached economically, and greater anonymity can be provided to respondents. This increases the generality of the data and could result in people being more willing to respond openly and honestly to the questions.

Cohen and Manion (1980) indicate that an ideal questionnaire possesses the same properties as that of a good law: it is clear, unambiguous and uniformly workable. Its design should minimize potential errors from respondents and codes. Since participation in surveys is voluntary, questionnaires should help to engage their interest, encourage their co-operation, and elicit answers as close as possible to the truth. Even though the questionnaire method presents advantages, it has its own limitations such as:

(i) the low response rate. A low response rate poses problems for the validity of the findings;

(ii) are not appropriate for respondents who cannot read and write;

(iii) there can thus be no assurance that the questions used in a questionnaire are understood and answered correctly by respondents; and

(iv) do not capture information outside the parameters of the structured items.

Despite the inherent problems of questionnaires, the end product can be satisfying, while the results of the questionnaire can facilitate the task of organizing and, analyzing the data and writing the research report. For this study, all four limitations have been mitigated as the 30 respondents represent the targeted demographic population of the secondary schools within the EC. Secondly, all terminology used in questionnaire was simple and could be understood by ECDoE Administrators. Finally, the questionnaire was formulated such that respondents could comment about anything that was addressed by the questions. Looking at these mitigation steps, it can be noted that the above limitations would not compromise the validity of questionnaire method.

4.5.8 DATA COLLECTION - QUALITATIVE INTERVIEWS

Hoskins (1998) defines semi-structured interviews as interviews that are conducted with a fairly open framework which allow for focused, conversational, two-way communication. Not all questions are designed and phrased ahead of time. The majority of questions are created before the interview and some during the interview allowing both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues. The purpose of a semi-structured interview is to obtain specific quantitative and qualitative information from the interviewee whilst obtaining general information relevant to specific issues.

The semi-structured interview technique builds into the questioning sufficient flexibility to capture insights that may otherwise be lost by the imposition of the 'next' structured question (Hoskins, 1998). In the present study, 15 ECDoE Administrators in Head Office and District were interviewed to gain factual information with regards to policy and practices in the process of provisioning of textbooks to public schools. There was also the need to gain an understanding of the effects of education policies that were implemented in 1998 and 2003 on the supply of books to public schools (refer to Appendix 2 for questions to Administrators).

The Modes of Inference method of analysing qualitative data was used once the interviews were conducted. Danermark, Jakobsen and Karlsson (2002) describe

inferences as logical preconditions of scientific reasoning and are thus the core of the scientific method. Inferences are descriptions of various procedures and ways of reasoning and arguing which are applied when the particular is related to the general.

Categories emerge from informants who provide context bound information (Cresswell, 1994). The researcher attempts to discover relationships or patterns (Poggenpoel in de Vos, 1998:366). The theory is generated from this (Neuman, 1997:46). Verification is used to ensure accuracy and reliability, which may not surface in the study (Cresswell, 1997). The researcher utilizes a variety of research methods for example the VSM for semi-structured interviews and statistical and factor analysis for school survey.

Each section consists of questions that are intended to elicit responses from the respondents. The questions were formulated around the constructs of:

- Biographical information;
- Perceptions with regard to policies and practices that guide decentralization in the EC education system;
- Views of Administrators about the effects of decentralization on the supply of textbooks to schools;
- Perceptions with regard to the implementation of policies and practices of provisioning of textbooks in a decentralized EC education system; and
- Areas of concerns and areas for improvements with regard to the process of supply of textbooks.

After each interview, informal non-recorded discussions took place with each of the respondents which allowed each respondent to bring to the interview matters they did not feel 'safe' to discuss while being recorded. It was felt that this was necessary especially where this researcher sensed that the recording could have compromised the interviews as well as the quality of information being shared. As a result of this process, the total interviewing time for all the respondents was increased by an additional 30 - 45 minutes to about 1.5 hours each. Therefore, the total interviewing time was 23 hours.

4.5.9 INTERVIEW PROTOCOL

There is no recipe for effective interviewing. The particular situation, characteristics of the participants and personal style of the interviewer interact to create a unique situation for each interview. However, some guidelines in the form of a protocol can be supplied. The following protocol which is a combination of the approaches of Field and Morse (1985), Patton (1987: 142-143), Cohen and Manion (1994), Frey and Oishi (1995), King (1995) and Jerling (1997) was applied in this study.

Before the interview, the protocol was to obtain the written consent of all the participants beforehand to record the interview and incorporate it in the research. Any notes would also be made available to the participants. Arrangements were made for a non-threatening venue that is isolated from noise. In all cases, participant's offices were used. The participants received reminders of the interview at least 5 days before the time in the form of a telephone call, e-mail or facsimile. All the respondents participated freely during the interview process in accordance with the suggestions made by Rubin and Rubin (1995) who state that qualitative interviewing should be characterized by being "flexible, iterative and continuous". Further, the interviewing schedule and questions were adapted during each interview in accordance with Rubin and Rubin's (1995) suggestion that the interviewing process should be conducted in such a manner that the interviewer does not overly pre-plan the questions. Guideline questions were prepared, which did allow for redesign as the research progressed. This researcher was guided at all times by the quest to elicit rich or thick responses and was always aware of the iterative manner in which questions should be developed when working within a constructivist paradigm.

Confidentiality and anonymity was ensured by adopting the following precepts. It was mentioned by all respondents that they were uncomfortable with the tape recorder as this could be used for political agenda. Therefore, the tape recorder was not used for all 15 interviews. Conformation with the respondent of the time and place is also important (Guba and Lincoln, 1994). All the interviewees expressed their discomfort regarding the

use of tape recorder, therefore it was not used in all the interviews to respect interviewees' request.

At the end of interviews, courtesy demands that the interviewer thank the respondent for his/her cooperation at the end of the interview. Additional interviews or additional opportunities for communication can be mentioned in this phase if it is clear that more information might be necessary. As a final courtesy, the interviewer followed up with a formal letter of thanks as proposed by Lincoln and Guba (1985).

Rough-draft notes, edited by the interviewer and then typed into final format were stored as soon as possible after the interview. The information obtained from any interview should be subjected to examination and further member checking (Lincoln and Guba, 1985:273). The interviewees were verified if they truly in the positions that they claimed by using updated organogram of the Department.

4.5.10 PROTOCOL FOR MAKING DATA EXPLICIT (EXPLICITATION)

Patton (1987: 144) describes analysis as "the process of bringing order to the data, organising what is there into patterns, categories, and basic descriptive units". The term 'data analysis' is deliberately avoided here in view of Hycner (1999: 161) who cautions that "analysis" has dangerous connotations for phenomenology. The following protocol, which is compiled and based on the guidelines proposed by Kerlinger (1986: 477-481), Strauss and Corbin (1990: 62-69) as well as Hycner (1999: 143-156), was followed step-by-step to make the data explicit and ensure the trustworthiness of the study:

Step 1: Reading of captured notes.

Step 2: Line-by-line explicitation.

Step 3: Labeling the phenomenon.

Step 4: Identification of categories.

Step 5: Description of categories.

Step 6: Integration of categories.

Step 7: Independent coder.

Step 8: Interpretation of the data.

4.5.11 LIMITATIONS OF THE STUDY

There are some methodological limitations that were identified in conducting this research project and these are discussed below.

Small sample sizes: the respondent rate from surveyed schools was small but represented the targeted demographic orientation of the schools such as formerly model c, township, rural. The particular concern was the lower response from rural schools, this introduced a strong bias towards urban schools. This could be attributed to lack of communication tools such as electronic emails and facsimile machines. The analysed quantitative data represented 37% of respondents and 3.5% of the population of 852 public secondary schools. However, a representative sample of 30 is the minimum statistically reliable number of observations from a population (Keller and Warrack, 2003).

New Role Players: some of the Administrators were fairly new in their positions, thus prohibiting them from being confident about information and limiting their historical familiarity with the work. Their predecessors were not available or were not willing to comment on the previous roles as this might conflict or expose the current role player.

Tape Recorder: use of the tape recorder had been planned in the interview sessions, however only one Administrator allowed the recorder and so for the other 14 interviewees note taking was used as the procedure for data collection. This compromised the researcher, as attention was divided between note taking, listening and probing. The presence of the recorder would have allowed the researcher to only take observation notes.

VSM and Lean Thinking: these approaches were applied as tools to measure the process of provisioning of textbooks. These tools were developed based on a manufacturing environment and theory. In this study, they are used in a service oriented environment that is largely of information flow versus material flow.

All of the above identified limitations were taken into account during the analysis and interpretation of the collected information to answer the research questions.

Decision making level table: It was noted that the developed model was established to assess decision making level in the Department for provisioning of textbooks to schools.

A model for measuring the degree of decentralization in the supply of textbooks was developed by combining four theories:

(1) The OECD methodology for measuring the degree of education decentralization divides educational functions into four groups:
    (e) the organization of instruction
    (f) personnel management,
    (g) planning and structures, and
    (h) resources.

(2) Fiske (1996) indicates that decentralization can be justified by devolving structure or content.

(3) Falleti (2004) noted four ways to measure decentralization:
    (e) the sub-national share of expenditures (SSE),
    (f) policy–making authority (PMA),
    (g) the type of appointment of sub-national officials (SOA), and
    (h) the territorial representation of interests (TRI).

(4) Agrawal and Ribot (2000) suggest that three distinct dimensions underlie all acts of decentralization:
    c. who are the actors,
    d. type of powers – create new rules, make decisions, implement and ensure compliance and adjudicate disputes; and
    c. accountability – upward and downward.

The theories used to develop the table were generally concerned about a politically driven reform whereas in this case the focus is on process efficiency.

4.6 ASSUMPTIONS OF RESEARCH

Cresswell (1994) argues that there are general assumptions that social research tends to follow. Six of these assumptions are discussed below and some are not relevant for this study.

4.6.1 THE ONTOLOGICAL ASSUMPTION

Social research is directed to aspects of the social reality. The *ontological assumption* asks the question: What is the nature of reality? The ontological assumption in qualitative research is subjective and multiple as seen by the participants in the study (Cresswell, 1994). In quantitative methods, there is a possibility that the sample being analysed may not be entirely representative of the population. This researcher is interested in the service delivery of education by the EC government to its citizens. The focus of this study will be to evaluate the provisioning of textbooks to public schools in the context of the Eastern Cape education system. In the service delivery of education in the EC, due to the reality of the socio-economic status of immediate school communities, the impact of the provisioning of textbooks by the ECDoE would not be the same to all schools.

4.6.2 THE TELEOLOGICAL ASSUMPTION

The teleological assumption of the research encompasses research as intentional and goal directed with the main aim being the understanding of phenomena (Mouton and Marais, 1990). The teleological assumption of this research project includes the exploration and description of the process stages and role of persons involved that will result in the description of the service delivery. The concepts of education decentralization, Lean Thinking and VSM are well explored and understood globally, however not in the concept of process of provisioning of textbooks to public schools. The teleological assumption for this study also refers to the applicability of the proposed decision making and VSM models and improvements to the concerned area and similar context elsewhere.

4.6.3 THE EPISTEMOLOGICAL ASSUMPTION

The relationship between the researcher and the researched is the epistemological assumption of the research. Researchers interact with the researched in qualitative studies and attempt to minimize the distance between them and those being researched (Cresswell, 1994).

The researcher, being a student at the University of Cape Town, is not part of the Department of Education therefore does not have inside information about

organizational politics and culture. However, the researcher was a learner at former township or "Blacks" only schools and thus has more understanding of those schools rather than rural and former model c schools. The researcher was aware of the epistemological assumption during interviews with Administrators and strived to minimise bias by standardization of questions.

4.6.4 THE AXIOLOGICAL ASSUMPTION

The axiological assumption emphasizes the role of values in the study. The qualitative part of the research admits the value-laden nature of the study which is minimal in the survey or quantitative part. These values and biases are actively reported together with the value nature of information gathered from the field (Cresswell, 1994). The researcher is not actively involved in the DoE and does not have any intentions to influence the education system except to propose process improvements. The study will therefore minimise value-laden. The researcher was mindful of his own values and biases, as well as the values and biases of other people involved in the study and these were reported where applicable.

4.6.5 THE RHETORICAL ASSUMPTION

The rhetorical assumption of the research asks the question: What is the language of research? Qualitative methods sometimes use informal language, which becomes personal and is based on the definitions and decisions that evolved during the study (Cresswell, 1994:5-6). This study consists of qualitative content, which emerges from semi-structured interviews with DoE Administrators and the context of a decentralized education system setting. The researcher was aware of the fact that the language of the different professionals may differ in meaning and contexts. The quantitative part of the research was structured questions prepared by the researcher which were distributed by facsimile to public secondary schools chosen at random. The questions were in simple English, however, there was little opportunity for respondents to ask if they didn't understand the question unless they contacted the researcher which did not happen in this present study.

4.6.6 THE METHODOLOGICAL ASSUMPTION

During research, a specific process is followed to answer the research questions. Both quantitative and qualitative paradigms as research methods were followed in the information gathering, analysis and synthesis phase of the research, which allows for both deductive and inductive processes respectively. The researcher began with a detailed literature review, followed by observations and then moved towards more abstract generalizations and ideas (Neuman, 1997). With regards to the quantitative part, the researcher is without an explicit conceptual framework and uses general but intelligent guesses to guide the research (de Vos, 1998). The combination of four different theoretical constructs was used to develop a model that was used to measure the effect and degree of decision making authority. Lean Thinking and VSM were applied to assess the process of supply and distribution of textbooks and the semi-structured interviews were used to test the effect of provisioning of textbooks to schools. For this quantitative research, two methods were used; a survey was distributed to over 80 schools. This was supplemented by statistical data from the Department.

4.7 STATISTICS OVERVIEW

Statistics was used in this study to analyse and interpret quantitative data gathered from the surveyed schools. The schools' survey was meant to assess the effect on the process of provisioning of textbooks as a result of implemented education system policies. The field of statistics can be broken down into two broad categories, descriptive statistics and inferential statistics. Descriptive as well as inferential statistics will be employed in this study. Descriptive statistics entails ordering and summarizing the data by means of tabulation and graphic representation and the calculation of descriptive measures. In this way the inherent trends and properties of the observed data emerge clearly. On the other hand, statistical inference draws conclusions about the population from which the sample was drawn by using the descriptive measures that have been calculated (Steyn, Smit, Du Toit and Strasheim, 2000). The basic taxonomy of the field of statistics looks like this:

1. Descriptive Statistics: and

2. Inferential Statistics: Estimation Statistics, Confidence Intervals, Parameter Estimation and Hypothesis Testing.

4.7.1 DESCRIPTIVE STATISTICS

Descriptive statistics allows a researcher to describe or summarize their data. For example, descriptive statistics for a study using human subjects might include the sample size, mean age of participants, percentage of males and females, range of scores on a study measure, etc.. Descriptive statistics are often briefly presented at the beginning of the Results chapter. Descriptive statistics describe the basic features of the data in the study. Descriptive statistics provide a powerful summary that may enable comparison across people or other units. The following two major characteristics of the variable will be examined. The first is to show how the variables differ (spread) mostly known as statistical variability such as range and standard deviation. Secondly, the central tendency or typicalness exhibiting how different units seem similar. Descriptive statistics simply summarise and describe the data in two ways: graphical and numerical.

4.7.2 INFERENTIAL STATISTICS

Inference statistics are usually the most important part of a statistical analysis and are used to allow a researcher to make statistical inferences that draw conclusion about the data. There are two main types of Inferential Statistics, estimation and hypothesis testing.

***Estimation Statistics*:** estimation statistics are used to make estimates about population values based on sample data. There are two types of estimation statistics, confidence intervals and parameter estimation.

a) Confidence Intervals: these statistics allow us to establish a range that has a known probability of capturing the true population value. There are many different

confidence interval formulae, for example for estimating the population mean, or the percentage of a characteristic in the population.

b) Parameter Estimation: parameter estimation statistics allow us to make inferences about how well a particular model might describe the relationship between variables in a population. A examples of parameter estimation statistics include a linear regression model.

Hypothesis Testing Statistics: hypothesis testing statistics allow us to use statistical data analysis to make statistical inferences about whether or not the data gathered support a particular hypothesis. There are many hypothesis testing procedures, the widely used ones include t-test, chi-square and ANOVA (Analysis of variance). Hypotheses testing will be the focus of this study and is thus briefly discussed below.

The factor analysis was conducted to identify the underlying structure of the data set. Factor analysis is a generic name given to a class of multivariate statistical methods whose primary purpose is to define the underlying structure in a data matrix (Kim and Mueller, 1978). The rationale for using factor analysis includes the following:

1. To identify underlying constructs or factors that explain the correlation among a set of variables;
2. To test hypotheses about the structure of variables;
3. To summarise a large number of variables with a smaller number of derived variables; and
4. To determine the number of dimensions required to represent a set of variables.

The dependent variable (Y) was the *change outcome* and the independent or explanatory variable (X) the *level of congruence* obtained. This study employs factor analysis to reduce the large number of variables into fewer underlying and meaningful factors. In this present study, there are four variables, three independent variables are the times (months) that schools receive textbooks after they have submitted the order requisition, time in weeks that schools take to return requisition forms to the Department and number of learners without textbooks. The dependent variable is the grade 12 pass rate.

4.7.3 PEARSON CHI-SQUARE TEST

The Pearson chi-square test is used to assess two types of comparison: tests of goodness of fit and tests of independence (Gorsuch, 1983). A test of goodness of fit establishes whether or not an observed frequency distribution differs from a theoretical distribution. A test of independence assesses whether paired observations on two variables, expressed in a contingency table, are independent of each other. The Pearson chi-square test allows researchers to test the independence of two variables. All chi-square tests are based upon a chi-square distribution, similar to the way a t-test is based upon a t distribution or an F-test is based upon an F distribution.

The probability value (p-value) is used to decide whether or not we can reject the null hypothesis. If the p-value is less than "alpha" which is typically set at 0.05, then the null hypothesis can be rejected. The idea behind this test is to compare the observed frequencies with the frequencies that would be expected if the null hypothesis of no association / statistical independence were true. By assuming the variables are independent, the test can also predict an expected frequency for each cell in the contingency table. If the value of the test statistic for the chi-squared test of association is too large, it indicates a poor agreement between the observed and expected frequencies and the null hypothesis of independence / no association is rejected.

The chi-square test provides little information about the strength (strong, weak, or perfect) or form (positive or negative) of association between two variables. Even though one can reject the null-hypothesis or accept the research hypothesis, they are dependent on each other. The chi-square measures are sensitive to variations in sample size and are very sensitive to departures from multivariate normality of the observed variables (Cooper and Emory, 1995).

For the purpose of this study, a contingence table was computed to test if the three independent variables have any associated relationship with the dependent variable, Grade 12 pass rate.

4.7.4 ANALYSIS OF VARIANCE (ANOVA)

The analysis of variance allows researchers to compare several groups of observations, all of which are independent but possibly with a different mean for each group (Kim and Mueller, 1978). A test of great importance is whether or not all the means are equal.
The observations all arise from one of several different groups (or have been exposed to one of several different treatments in an experiment). The classification is 'one-way' according to the group or treatment. The Two Way Analysis of Variance is a way of studying the effects of two factors separately (their main effects) and (sometimes) together (their interaction effect).

ANOVA is used when the study involves 3 or more levels of a single independent variable. The null hypothesis for ANOVA is that the mean (average value of the dependent variable) is the same for all groups. The alternate or research hypothesis is that the average is not the same for all groups. The ANOVA test procedure produces an F-statistic, which is used to calculate the p-value. If $p < 0.05$, the null hypothesis can be rejected. The conclusion is that the average of the dependent variable is not the same for all groups.
With ANOVA, if the null hypothesis is rejected, then all that is known is that at least 2 groups are different from each other. In order to determine which groups are different from which, post-hoc t-tests are performed using some form of correction to adjust for an inflated probability of a Type I error. For the purpose of this research, Microsoft Excel Statistical Programme and Eviews were used to compute ANOVA to measure if independent variables (time books delivered after requisition submission, time the requisitions are sent to district office after being completed by schools and number of learners without textbooks) have similar averages to the dependent variable, Grade 12 pass rate.

ANOVA assumptions: Keller and Warrack (2003) states the following ANOVA conditions that need to be met if the statistical measure is valid:

a) Model errors are assumed to be normally distributed with a mean of zero, and are to be randomly distributed;
b) The samples are assumed to come from a normally distributed population; and
c) Variance is assumed approximately constant for all factor levels - statistical software packages will perform both the tests for equal variances.

4.7.5 LINEAR REGRESSION

Linear regression is a common statistical data analysis technique. It is used to determine the extent to which there is a linear relationship between a dependent variable and one or more independent variables. There are two types of linear regression models, simple linear regression and multiple linear regression.

In simple linear regression, a single independent variable is used to predict the value of a dependent variable. In multiple linear regression, two or more independent variables are used to predict the value of a dependent variable. The difference between the two is the number of independent variables. In both cases, there is only a single dependent variable.

Linear Regression - Data Considerations: the dependent variable must be measured on a continuous measurement scale and the independent variable(s) can be measured on either a categorical or continuous measurement scale. There are several other assumptions that the data must satisfy in order to qualify for linear regression.

Correlation and Regression: simple linear regression is similar to correlation in that the purpose is to measure to what extent there is a linear relationship between two variables. The major difference between the two is that correlation makes no distinction between independent and dependent variables while linear regression does. In particular, the purpose of linear regression is to "predict" the value of the dependent variable based upon the values of one or more independent variables.

Kervin (1992) notes that one purpose of linear regression is to predict a dependent variable based on the value of one or more independent variables. A linear regression

model with only one independent variable is called simple linear regression. However, most real world phenomena are multi-factorial in nature, meaning there is more than one factor that impacts on, or causes changes in the dependent variable. In order to predict the dependent variable as accurately as possible, it is usually necessary to include multiple independent variables in the model. Multiple linear regression allows the testing of how well a dependent variable can be predicted on the basis of multiple independent variables.

One way to measure the overall predictive accuracy of a regression model is the R-square value. The interpretation of R-square is: "The amount of variance in the dependent variable that can be explained by the model." If the R-square value is 1.0, this means the model explains 100% of the variance and so the model will produce perfect predictive accuracy. This never happens in the real world though. The point is, the closer to 1.0 the R-square value is, the better the model. The closer the R-square value is to 0, the worse the model. For the purpose of this research, Microsoft Excel Statistical Programme and Eviews were used to compute linear regression to measure if independent variables (time books delivered after requisition submission, time the requisitions are sent to district office after being completed by schools and number of learners without textbooks) can be used to explain or "predict" the dependent variable, Grade 12 pass rate.

Regression Conditions: Keller and Warrack (2003) state the following regression conditions that need to be met for the model to be statistically valid:

a) The probability distribution of variances is normal;
b) The mean of the distribution is zero;
c) Relative importance of predictors cannot be determined from the size of their coefficients if the:
    - coefficients are scale-dependent, they depend on the units and increments in the original data
    - coefficients are influenced by correlation among the input variables; and
d) At times, some of the independent factors will be correlated with each other. This condition is known as multi-collinearity, which causes:

- estimates of the coefficients to be unstable with inflated p-values,
- difficulty isolating the effects of each independent variable,
- coefficients to vary widely depending on which independents are included in the model.

4.8 ANALYZING QUANTITATIVE DATA - MODES OF INFERENCE

According to Babbie and Mouton (2003: 490), there is no one "neat and tidy approach" to qualitative data analysis. However, Hitchcock and Hughes (1995) state that within the hermeneutic tradition, there is an acceptance that the human sciences should be concerned with the 'inner' understanding of 'meaningful' conduct. The modes of inference method may be used in analyzing data in social science research and this may include deduction, induction, abduction and retroduction. Danermark, Jakobsen and Karlsson (2002) describe inferences as logical preconditions of scientific reasoning and are thus the core of the scientific method. Inferences are descriptions of various procedures and ways of reasoning and arguing which are applied when the particular is related to the general. Reasoning, the ability to analyze, abstract, relate, interpret and draw conclusions, is a fundamental precondition for all knowledge and knowledge development.

Deduction refers to inference where conclusions follow in a strictly logical way from given statements. Arguments are substantiated with various assertions and observations. Deductive logic provides rules for what is a logically valid conclusion based on given statements. However, deduction does not reveal anything new about reality beyond what is already in the statements. Deductive conclusions are analytical conclusions. The validity of the conclusion is dependent on following the logical rules for deduction, independently of what reality is like. In analytical inference, the conclusion is implicit in the premises. "This means that it does not give any guidance on how the researcher, from observing particular phenomena, can gain knowledge of the abstract structures and mechanisms that make these phenomena possible" (Danermark, Jakobsen and Karlsson, 2002: 84).

Danermark, Jakobsen and Karlsson, (2002) discuss ***induction*** as inference conclusions that entail addition of new knowledge beyond what is in the statements. The induction process starts from something known and given and draws new conclusions which reach beyond this.

Inductive inference implies that, from a number of observations of individual phenomena, general conclusions are drawn which are assumed to be true of a larger number of phenomena than those that have been observed. Inductive inference can be a generalization over time and also of a larger population (Danermark, Jakobsen and Karlsson, 2002).

Inductive inferences were made when organizing and analyzing interviews, documents and observation data in this research. For instance, when ECDoE Administrators were asked about decision making, most of them referred to the Head Office which raises the question of centralization.

There are external limitations to inductive inference regarding the knowledge that cannot be reached with induction. That is, there will never be certainty that what is observed is true also of the unobserved occurrences.

A third mode of inference applied in this critical post-structural research is ***abduction.*** An abductive mode of inference encompasses a defined logical form comparable to induction and deduction, and on the other hand offers a more in-depth perception of reality.

Abduction involves the re-description or re-contextualization of statements. It encompasses ways of reasoning, thinking and arguing in a wider sense. Abduction provides a type of knowledge that cannot be acquired either through deduction or inductive generalizations. Abduction is essentially applied in the policy analysis of the Imbewu Decentralization Report, 1999 and LSM Supply Chain Review, 2003 to gain a deeper knowledge of social meanings, power structures, mechanisms in the ECDoE. This mode of analysis was critically applied in presenting data results following rigorous coding and recoding to gain a deeper understanding of the premises as generated from the respondents and through re-contextualizing these in relation to theoretical perspectives of decentralization and the textbooks supply process as measured by Lean Thinking tools.

4.9 TRUSTWORTHINESS OF THE RESEARCH METHODS

In order to ensure trustworthiness during the research, the researcher would utilise the methods of trustworthiness proposed by Lincoln and Guba (1985). Lincoln and Guba (1985:300) use the terms:

a) Credibility in contradiction to internal validity; b) Transferability in contradiction to external validity; c) Dependability in contradiction to reliability; and d) Conformability in contradiction to objectivity.

The criteria of trustworthiness, as proposed by Lincoln and Guba (1985), is utilized in this research being done to establish trustworthiness in assessing the process of supply of textbooks and to ensure validity and reliability of process used to gather information, synthesis of that data and reporting. Every researcher should be able to answer the question of reliability and validity of the data set obtained with a measuring instrument in order to have faith in the results obtained and the conclusions drawn from the results (Kerlinger and Lee, 2000). Reliability and validity are effective measures for assessing the usefulness of a measurement tool.

Reliability and validity are important issues in all research. Reliability and validity address issues about the quality of data and appropriateness of the methods used as described by Flick (1998). Qualitative research analysis has an element of subjectivity as the researcher is not aloof from the process, but is intimately involved with it from the start according to Lacey and Luff (2001). Quantitative has an element of generalisation or inference from a representative sample.

It is especially important to demonstrate that the data analysis was rigorous in view of the common criticism that qualitative results are anecdotal and lack scientific rigour (Lacey and Luff, 2001; Mays and Pope, 1995). Mays and Pope (1995) argued that qualitative research is an assembly of anecdote and personal impressions and is strongly subject to researcher bias. It is also believed to be difficult to reproduce. The question with regard to the lack of generalisation also arose.

If there is no transparency in the method, and changes were made to well-known methods it might seem that there could be a method-reporting deficit. Another view is also that all research is selective and that there is no way that the researcher can in any sense capture the literal truth of events (Mays and Pope, 1995).

4.9.1 VALIDITY

Validity addressed the appropriateness of the method to the research question, as well as the interpretation of the data according to Flick (1998). The researcher took specific steps in order to ensure valid research results and to reduce possible error and bias as described by various authors, such as Eden (1992); Hancock (2002); Martinsuo (2001); Mays and Pope (1995); and Mathers et al. (2002).

During analysis, a special effort was made to ensure construct validity (referring to the building blocks of innovation), by defining the constructs unambiguously. This was done by using "in vivo" codes as described earlier in this study. Adequate and systematic use of the original data (using verbatim quotes) in the presentation of the findings was also an effort to ensure validity as is typical of Grounded Theory or Modes of Inference as the following was applied:

a) The methods applied to determine the sample minimised the risk of possible bias. The techniques that were applied during the interviews supported validity.
b) The researcher did not influence responses from the participants by, for instance, avoiding raising a personal perspective in any way.
c) The researcher endeavored at all times to fairly and accurately represent the data collected and to be transparent in describing the methods used.
d) These methods included constant comparison, analytic induction and deduction.
e) The researcher also checked for negative or deviant cases to test interpretations by using the methods already described, as well as conducting a literature review.
f) Using a combination of qualitative and quantitative techniques enhanced the validity of the study through verification (examining and reflecting) by the participant and the listening skills of the researcher. This technique assisted the researcher and the participants to reflect critically upon and understand the dynamics of the process of provisioning of textbooks.

Validity of a measurement instrument is defined as "the extent to which differences found with a measuring tool reflect true differences among respondents being tested (Cooper and Emory, 1995). Specifically, discriminant validity looks at the disagreement

among scales used to measure concepts that are not expected to be related. No information is available on the validity of the provisioning of textbooks or education system to improve the supply of textbooks or more specifically on the discriminant validity thereof. The provisioning seems to possess face validity and based on the coverage of theoretical dimensions, also content validity.

The quality of the research is gauged against four criteria which according to Yin (2003: 34) are the "construct validity", "internal validity", "external validity" and "reliability".

According to Yin (2003), construct validity refers to the degree to which correct operational measures for evaluating the concept under study are applied. Construct validity is upheld when the researcher uses multiple sources of evidence as well as establishing a chain of evidence during the data collection phase.

To ensure quality, the construct validity criterion was upheld during this research by the researcher using multiple sources of evidence. Firstly, all the recorded interviews were transcribed verbatim, and these transcripts acted as the base protocols from which and where possible, further evidence was collected. This present study sought evidence to substantiate statements collected from conducted interviews, a survey and ECDoE Reports and PSAM Annual reports. Further, the quality criterion of maintaining a chain of evidence has been upheld, as all the written data gathered during the data collection phase is available for scrutiny.

External validity is the extent to which a study can be generalized to other similar contexts and ensured through a sound research design. External validity addresses the question of generalisability, that is to whom can this experiment's findings be generalised? (Campbell and Stanley, 1963). Within the constructivist paradigm, Lincoln and Guba (1985) and Trochim (2004) state that it is more appropriate to speak of the "transferability" of the study as opposed to the external validity. Transferability refers to the extent to which a study can be applied to other contexts and according to Trochim (2004: 1) is ensured by the researcher who does "…a thorough job of describing the research context and the assumptions that were central to the research".

Internal validity is ensured when a causal relationship is shown to exist between two sets of conditions and the effect cannot be explained as being merely spurious. Internal validity is upheld during the data analysis phase and is ensured primarily through the logic of the models and the adequate addressing of rival explanations (Yin, 2003). Within the paradigm of qualitative research, Trochim (2004: 2), states that internal validity is best translated as "credibility", which refers to the extent to which the researcher is able to demonstrate that the results are believable.

Trochim (2004) states that within qualitative research, the concept of reliability is to an extent moot because we cannot measure the same thing twice. To measure twice is in effect the measuring two different things. Trochim (2004: 1) therefore argues that it is more appropriate to use the concept of "dependability", which emphasizes the researcher's responsibility "to account for the ever changing context within which the research occurs."

4.9.2 PARTICIPANT VALIDATION

The researcher established the credibility of data through participant checks where the participants were presented constantly with the analysis of the data for their confirmation or revision. This approach is supported by various authors on research methodology such as Flick (1998); Lacey and Luff (2001); Martinsuo (2001); Mathers et al. (2002) and Mays and Pope (1995).

As indicated earlier, in the case of interviews, the participants are those ECDoE Administrators that are directly responsible for the supply of textbooks, refer to Table 8 above. The public schools are affected by the performance of the Administrators and application of the policy. As stated at the beginning of this section, validity and reliability are important to any research study. Reliability depends a lot on the way in which the researcher applied the various processes within the study. Rigour is such a criterion and will be discussed now.

4.9.3 RIGOUR

To ensure rigour, a systematic research design, data collection, interpretation and communication approach was followed as described in the Grounded Theory methodology. The aim was to create an account of the method and data, which could stand independently. Therefore, they could be analysed in the same way, leading to the same conclusions and producing a plausible and coherent explanation of the subject in question as described by Mays and Pope (1995) and Pope et al (1999).

The systematic and formal process of data collection, analysis and theory generation formed the basis for credibility, validity and rigour as described by Douglas (2003). The researcher guarded against inaccuracies and misleading interpretations by various means including comparative analysis, participation validation and literature reviews (Douglas, 2003).

4.9.4 RELIABILITY

Reliability means demonstrating that the operations of the study, such as the data collection procedures could be repeated with the same results. It addressed the accuracy of the research method and techniques to produce data (Cano, 2004).

Therefore an attempt was made to document and explain the data collection and data analysis method in great detail as described by Mays and Pope (1995), as well as Flick (1998). Data recording sheets were designed to ensure consistency when capturing information.

Moving between data collection and data analysis and having the means to return to the participant for clarification minimised the possibility of the researcher becoming biased or forming an unqualified opinion which might have lowered the reliability of the subsequent theory as supported by Leonard and McAdam (2001). Verifications by the participant and the analysis methods used increased the reliability. Referring to external evidence to test the conclusions from the analysis as appropriate also strengthened the reliability.

Reliability is synonymous with dependability, stability, consistency, predictability and accuracy (Lord and Novick, 1968). Cronbach's Coefficient Alpha of 0.7 and above is acceptable as being reliable estimator (Martins 1989). When the assumption of essential standard deviation equivalence of the components is violated, alpha is *not* an unbiased estimator of reliability instead it is a lower bound on reliability. Alternatively, the standardized Cronbach's α can also be defined as

$$\alpha = \frac{N \cdot \bar{r}}{(1 + (N-1) \cdot \bar{r})}$$

where N is the number of components (items or testlets) and $\bar{r}$ is the average of all (Pearson) correlation coefficients between the components. Lord and Novick, 1968 maintained that conditions to meet Cronbach's coefficient alpha include:

a) The arguments must be either numbers or names, array constants, or references that contain numbers;
b) If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included; and
c) If array1 and array2 are empty or have a different number of data points, PEARSON returns the error value.

Cronbach's Coefficient Alpha was computed for the four measured variables, a) time in weeks for schools to return requisitions to the district office, b) Grade 12 pass rate, c) learners without textbooks, and d) time, in months, that it takes for textbooks to be delivered after schools have placed the order. The Alpha was 0.965 which reflects that for the chosen sample, the measuring instrument is reliable, accurate or high on precision.

4.10 ETHICAL ISSUES

Ethical issues were considered in this research in order to deal with the dilemma of striking a balance between the role of the researcher and the rights and values of the research participants. According to Remenyi (1998: 110), there are three major ethical considerations

to consider when undertaking research. These are how the "information is collected", how the "information is processed" and lastly, "how the findings are used". Remenyi (1998) states that, when applying the first ethical consideration, namely how the information is collected, it is necessary for the researcher to be open and honest with the informants, to keep informants anonymous or the information they offer confidential if so requested, and that information should not be obtained under duress.

Gaining access to organizations and schools was negotiated with the relevant authorities. All ethical questions were addressed and observed before and during data generation and collection "by seeking subject's agreement to be interviewed and quoted, negotiating release of transcripts etc." (Gough, 2003: 3). Letters stating the purpose of the research by the researcher and supervisor were sent, refer to Appendix 7. The University of Cape Town Ethics Form also accompanied the school questionnaires and the request for interviews, refer to Appendix 8.

Participants were briefed about the purpose of the research and their rights as participants in the research before data collection. This was done to ensure that there was informed consent, freedom of choice to take part and to place some form of responsibility with participants with regard to what the answers they would be giving (Cohen and Manion, 1994; Bell, 1999). As De Vos et al., (1998: 23) put it "the final responsibility for ethical conduct rests squarely with the researcher concerned".

Violation of privacy was avoided by acting with the necessary sensitivity where privacy of the subjects was relevant and by respecting anonymity and confidentiality of the information provided on or by respondents. However, there were no incidences where interview participants felt that their names or what they were saying needed protection and privacy through confidentiality. Therefore confidentiality never became a challenge or dilemma in this research. Particular attention was paid when probing "sensitive and personal information from subjects" (De Vos et al., 1998: 25) to avoid exposing respondents to the possibility of emotional harm. In analysing data, care was taken to avoid betrayal or breach of trust. Letters of thanks were written to all those who provided information and access to the institutions. The research is a critical analysis of policy construction and interpretation and, for ethical

reasons, it is presented as such, avoiding criticism and offering space to invite readers to consider it as a valuable resource in policy research.

Ethical considerations were taken into account in the questionnaire and the interpretation of data. Participants were given an explanation of the purpose of the questions. They were also given the chance to remain anonymous if they wished. This was not only to allow them to freely provide information but also to give informed consent. In the final analysis and write-up of this research, the respondents' names have been eliminated from the text for ethical reasons.

According to May (2001: 60), 'informed consent' refers to freely given agreement on the part of the researched to become a subject of the research process. However, this is not only based on a complete understanding of the aims and processes of the research itself, but also may be assumed to encompass any consequences that follow from its publication in the public domain. A researcher might, and in many cases ought to take all possible steps to protect the identity of any person in the anticipation of any information being used for purposes other than those intended.

The respondents are given due recognition in the acknowledgments without mentioning their names.

Remenyi (1998) states that when processing information, it is important that the researcher avoids any manipulation because of his or her personal biases. Further, the findings must be honestly presented and not manipulated or adjusted merely to satisfy the researcher's biases. Remenyi (1998) also states that sometimes researchers are often not aware of their biases, but even if they are biased the integrity of the research is maintained if they declare their bias. In light of this statement, this researcher declares that the only conscious bias known is the desire to understand the process of provisioning of textbooks to public schools in the EC. After the completion, the research thesis for the study will be available at the University of Cape Town and will be discussed with the Department.

The balance between the benefits of the research against the potential risks to the informants will be of utmost importance during the research. The interesting aspect that the researcher experienced was that the interviewees were uncomfortable with tape recording. In summary,

the researcher, during this research followed the basic principles of ethical social research as indicated by Neuman (1997:455), namely:

a) Ethical responsibility rests with the individual researcher;
b) Subjects should not be exploited for personal gain;
c) Informed consent is required;
d) Honour all guarantees of privacy, confidentiality and anonymity;
e) Do not coerce or humiliate subjects;
f) Use the research method that is appropriate to the topic;
g) Detect and remove undesirable consequences to research subjects;
h) Anticipate repercussions of the research or publication of results;
i) Identify the sponsor who funded the research;
j) Release the details of the study design with the results;
k) Make interpretations of results consistent with the data;
l) Use high methodological standards and strive for accuracy; and
m) Do not conduct secret research.

The researcher was present at all interviews and this contributes to ensuring ethical consideration. The next step in the information gathering, analysis and synthesis phase after interviewing and observing is the analysis of data being obtained which done is in Chapter 5 below.

4.11 CONCLUSIONS

The research design to gather relevant information and data in order to answer the research questions was a combination of qualitative and quantitative methods. A combination of qualitative and quantitative methods, which is ex-post facto research was conducted. To gather qualitative data, semi-structured interviews were conducted with education administrators and policy makers and questionnaires were sent to public high schools within the Province. The questionnaire was supported by the statistical reports that are produced by the Department using different consultants including PASA. For analysis and interpretation, trends, patterns, similarities and differences were identified by using Modes of Inference for

qualitative data and literature review. The statistical analysis for the results of the questionnaire such as descriptive analysis, chi-square and regression were employed to determine factor analysis and inference probabilities.

In this chapter, the various data collection procedures to be used in this study were discussed together with a theoretical substantiation for using such methods. The design and composition of the questionnaire and the interview schedule, sampling techniques and the rationale behind it, and the respondents and their biographical details were discussed.

Rigorous or quality research started with a clear paradigm. Rigorous research is also a function of the degree of consistency and the complementary relationship which exists between the research design and the research methodology. Quality is a function of the extent to which the researcher has satisfied the tests of construct, internal, external validity and reliability. The instruments used to gather data to answer the research questions were:

1. Literature review: this covered relevant legislation, journal articles, books and electronic documents available;
2. Internet mailing lists: a number of mailing lists were identified and consulted in order to obtain nominations for institutions or other individuals with relevant experience;
3. E-mail and facsimile postings: identified individuals were contacted electronically. Correspondence with respondents was mostly by facsimile and some e-mail;
4. Web pages: web pages were consulted to obtain details on the activities of interested parties;
5. Semi-structured interviews: ECDoE Administrators were interviewed using open-ended questions; and
6. Questionnaires to schools: structured questions were used.

Considering the research aim and objectives, the research design of this study is based on a qualitative approach. The researcher is interested in the experiences, views, perceptions and personal opinions of various parties such as ECDoE administrators, District Office personnel, School principals or LSM coordinators and textbook suppliers. This was supported by quantitative data from 30 surveyed schools within the EC Province.

Thus the research question dictated the research design. Subsequently, this research was carefully designed and this design has the following characteristics:

- It falls within the qualitative paradigm supported by a quantitative survey of randomly chosen schools;
- It is of the ex-post facto kind; and
- It also makes use of secondary data.

Therefore ex-post facto research was used with both quantitative and qualitative techniques for gathering data, resulting in a triangulation of the results that are discussed in chapter five below.

CHAPTER 5 - RESULTS, FINDINGS AND DISCUSSION

This chapter elucidates the results obtained by utilising the research design and methodology set out in the previous chapter of the study. The chapter discusses findings contained as common themes and trends that can be determined from the results. The findings should address the research problems identified in chapter 1 and allow conclusions to be drawn and recommendations made.

5.1 POLICIES AND DECISION MAKING IN THE SUPPLY OF TEXTBOOKS

The policies employed by National Department of Education that affect provisioning of textbooks to public schools are SASA and National Norms and Standards for School Funding and the one established by the ECDoE is LSM Review Report (2003). The main focus of the study was to ascertain if these policies support the process of supply of textbooks. The model developed as indicated in Table 9 below, is a combination of theories from four sources that evaluate decentralization governance of political systems. The theories were used to measure the effectiveness of the set policies and are summarised below.

(1) The OECD methodology for measuring the degree of education decentralization divides educational functions into four groups:
- the organization of instruction,
- personnel management,
- planning and structures, and
- resources.

(2) Fiske (1996) indicates that decentralization can be justified by solving structure or content.

(3) Falleti (2004) noted four ways to measure decentralization:
- the sub-national share of expenditure (SSE),
- policy–making authority (PMA),
- the type of appointment of sub-national officials (SOA), and
- the territorial representation of interests (TRI).

(4) Agrawal and Ribot (2000) suggest that three distinct dimensions underlie all acts of decentralization:

- who are the actors;
- type of powers – create new rules, make decisions, implement and ensure compliance and adjudicate disputes; and
- accountability – upward and downward.

The development of the model to measure the degree of execution of work, decision making, enforcement of decisions and policies, approval and organizational structure in the provisioning of textbooks to public schools in the Eastern Cape has been developed using the four above-mentioned theories. These were used to measure the degree of decentralization at government levels from central to local or regional actors. Some of the variables or factors were combined as they may have similar meaning and interpretation for the measured process. For instance, type of power by Agrawal and Ribot (2000) has been combined with Falletti (2004) policy making authority, personnel management in OECD methodology was combined with the type of appointment of sub-national officials (SOA) from Falletti (2004). The territorial representation of interests (TRI) from Falletti (2004) and who are the actors by Agrawal and Ribot (2000) have been incorporated under Stakeholders. It should be noted that the study only assessed activities within the Department, other external factors were considered as background information in the study but not measured.

Table 9: Model to measure the degree of decentralization of Supply of Textbooks

Activity in Supply of Textbooks	Execution	Decision making	Enforcement	Approval	Structure	Content	Accountability	Stakeholders
Curriculum Development	ECDoE	ECDoE	ECDoE	NDoE	No	Yes	Minister	ECDoE, schools, consultants, PASA, NDoE
Book selection	ECDoE	ECDoE	ECDoE	ECDoE	No	Yes	HOD ECDoE	ECDoE, schools, consultants, PASA, DO
Cataloguing	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE, schools, consultants, PASA, DO
Compiling of requisition forms	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Distribution of requisitions to schools	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE, DO
Distribution of requisitions to ECDoE	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	schools, DO
Filling of catalogues by schools	Schools	Schools	Schools	Schools	Yes	No	DO	schools
Capturing of requisitions	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Cleaning of data	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Placing of orders to publishers	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Delivery of books to schools	PASA	PASA	PASA	PASA	Yes	No	HOD ECDoE	ECDoE, schools, PASA, DO
Asset management of school textbooks	Schools	Schools	Schools	Schools	Yes	No	SGB	schools
Budgeting	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Procurement of Service Providers	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE
Payment of service providers	ECDoE	ECDoE	ECDoE	ECDoE	Yes	No	HOD ECDoE	ECDoE, schools, DO

DO = district office
ECDoE = provincial department of education, Eastern Cape
PASA = Publisher's Association of South Africa or member the Association
NDoE = National Department of Education
HOD = Head of Department
SGB = School Governing Body

There are 15 broad activities that take place in the process of supply of books to schools as identified during interviews and supported by LSM Review Report (2003). The rows in the model reflect supply activities and columns represented decision making levels. 12 of 15 decision making functions and authority in the supply of textbooks take place mainly in the Head Office (provincial) except asset management of textbooks and curriculum development. There is little involvement of schools in decision on the supply of textbooks into their premises. Most (12 of 15) of the execution in the process also takes place in the provincial office.

There is little involvement of parents or affected general citizens in the process of supplying of textbooks to schools. Thus, less accountability of ECDoE to constituents or to the clients of the education system i.e. EC citizens which it aspires to serve. Putman (1993) found that regional municipalities with downward accountability performed better that those accountable to the central government. The results from the table showed that only book selection from pre-approved list by Department and curriculum development activities are concerned with content of education and many stakeholders are involved. The choice of textbooks by the Head Office, instead of schools, could mean that the Department intentionally influences the education content, what information is imparted to learners so that they shape learners (citizens) early in life. This concern could be interested in political justification to promote democracy and national unity. All other activities in the process of textbooks supply are concerned with organizational structure or protocol of ECDoE as an institution. The Provincial office has absolute power in this regard.

Budgeting and financial allocation of the school's textbook is determined at central level without enquiring about or knowing the needs of the school. This could limit the effectiveness of the process as schools would better know their own needs and priorities. This would require district office to monitor performance.

There needs to be accountability of the retention plan for schools to keep a textbooks at least for three years. Currently the accountability lies with School Governing Body (SGB) and if the SGB is ineffective, then the school is left unaccountable by the Department, which is an expensive exercise. SGBs in African schools are generally weak with low parental participation, (DoE, 2006). The FFC (2005) report emphases that in the surveyed provinces, schools had weak retrieval plans.

All other activities, decisions and approvals for supply lie in the Provincial office. It is evident from the developed table that for the supply or provisioning of textbooks to schools, the system is still highly centralized. Most activities in the process of textbooks supply, from decision making until execution, take place in the provincial office. After process streamlining, additional resources in the province office could assist to improve the effectiveness of the process or a different approach could be employed such as outsourcing as is the case in KwaZulu Natal.

The centralization system of activities including decision making can have a positive impact in the speed delivery because most the decisions take place in the same office, Zwelitsha Head Office. However, the speed advantage was not evident on this particular research study.

5.2 SCHOOL TEXTBOOK SUPPLY VALUE STREAM MAPPING

To understand the supply and distribution of textbook in the ECDoE schools, the initial step was to draw a layout and process flow. Within the DoE, the process involves movement of mainly written information either through facsimile, postage or electronically from ECDoE to district office and to schools and vice versa. Thereafter current-state VSM of the process was drawn to detect possible areas where *muda* exist. After the waste has been detected, the future state VSM was drawn and improvement areas suggested to eliminate waste, which is the concern of this study. The VSM as a visual aid should be able to identify and recommend areas of improvement so that waste particularly of time, can be reduced to improve delivery of books to schools.

5.2.1 PROCESS FLOW

To develop and draw the VSM, the first step is identify the process flow to reflect the activity, area where the activity is taking place, who is doing the activity, frequency and duration, refer to Table 10 below.

Table 10: Process flow of provisioning of textbooks to schools

Process Step	Process Area	Description	When	Duration
Book selection	Provincial area	Evaluation and selection of preferred textbooks		18 months
Preparation of LSM requisitions	Provincial office	Preparation of textbook catalogues & requisitions according to grades and districts	First week of March	2 months
Requisitions to district office	Provincial office	Each district is sent budgets and requisitions for all schools in its jurisdiction	By the end of first quarter	2 weeks
Requisitions to schools	District office	Each school is sent a budget and requisition for textbooks for the following calendar year	By the second week of second quarter	2 weeks
Receipt and return of requisitions to district office	Schools	Schools fill their textbook requirements, which one and volume, not to exceed budget	Three weeks before end second quarter	2 weeks
Receipt of requisitions from schools and forward them to provincial office	District office	23 district offices receive requisitions from schools and forward them to the provincial office	By last week second quarter	2 weeks
Receipt of requisitions and processing them	Provincial office (LSM)	Receive, data capturing of requisitions. Analysis of required textbooks	By second week of third quarter	2 months
Procurement of publishers	Provincial office (Supply	Tenders, Request for Proposal (RFP) and procurement of	By end August	1 month

	Chain)	publisher		
Distribution of orders to publishers	Provincial Office	Distribution of purchase orders to publishers	By first week of September	2 weeks
Delivery and payment	Publishers and Schools	Delivery of books to schools and delivery notes to the province. Payment made to publishers.	Proof of delivery	3 months and plus
Total time (inside ECDoE)				**7,5 months**

The evaluation and selection of suitable textbooks and delivery and payment were not assessed in this study by VSM because they take place outside of the ECDoE, provincial, district and schools. The change of textbooks happens once in five or ten years and is usually informed by a curriculum alteration which is a National Department responsibility (LMS Review Report, 2003). Additionally, the delivery of books is made by publishers, hence this activity is not measured by this present study.

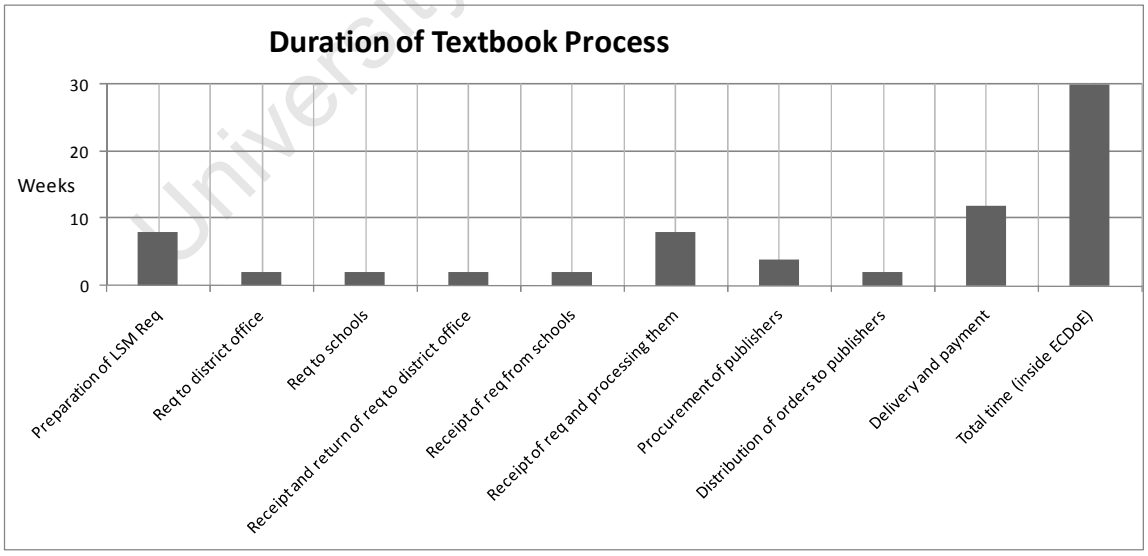


Figure 5: Showing duration (weeks) of activities in the supply of textbooks process

It is notable from the Figure 5 above that preparation of requisition, receipt of requisitions from district offices and delivery and payment occupy the longest times in the process. Meaning that any improvement on the three activities can substantially cut the process time.

Rule 1: All work shall be highly specified as to content, sequence, timing, and outcome. According to the conducted interviews and LSM Review Report (2003) the roles and responsibilities are not clear and not specific to a person. Schools send their requisitions to the district office not to a specific person. The requisitions can be lost which can give rise to mop-up requisitions, thus either furthering shortage of the textbooks, or purchasing of books that are not a priority. For instance, the requisition for 2008 calendar year from Loyiso Secondary School was missing and could not be traced between the district office and Head Office. This led to mop-up requisition and delay in the delivery of textbooks with some arriving in March (three months delay). The mop-up requisition did not consider Grade 12 Physical Science books, such that the researcher voluntarily purchased 30 Physical Science textbooks for the school. Further, the requisition form does not specify the deadline or return date to the district office. This is left to schools and some only respond as result of pressure from district officials.

Rule 2: Every customer supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses. This promotes a system that is direct and has response if the material/information was received with all its necessities. Currently there is no response system that shows or indicates that information has been received by Department or schools. If there was a receipt response mechanism the missing requisition form in the Loyiso Secondary School example was going to be tracked faster and easier. This would also lessen the mop-up requisitions and shortage of the books in schools.

Schools are sometimes unaware of what is required of them in the requisition. This ambiguity leads to inability by some schools to complete the requisition as confirmed by LSM Manager: “some schools find it difficult to fill the catalogues from district offices”.

Rule 3: The pathway for every product and service must be simple and direct. This is where the 20% time saving comes into play. Activities in the district office do not add value in the supply of textbooks as they only distribute information and material. The reduction in time from 8 weeks to 2 weeks could be achieved by establishing direct lines between ECDoE and schools. This double handling can result in requisition forms being lost or missing in the system. FFC argued that some of the provincial departments repeatedly asked for the requisition forms to be resubmitted/resent claiming they had not been received. Furthermore, it is believed that the provincial tender board procedures and processes contribute to the supply delays and the shortages of textbooks in schools.

Rule 4: Every part must be manufactured for a specific customer and manufactured when needed. The requisition forms reflect the number and type of textbooks that schools require for the next academic year. Every part produced and delivered for a specific school and this has been reflected by the information in the requisition forms.

Rule 5: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization. From the surveyed and conducted interviews, the process of provisioning of textbooks follows the LSM Review Report 2003. There have been appointments of Managers where responsibilities include leading the LSM unit. This has compromised the necessary attention and focus to the process, thus many have not stayed for long and thus disrupted the continuity. The supply is treated as an annual project. In this project mode it is hard to comprehend that there is systemic continuous improvement as proposed by Rule 5.

5.2.2 CURRENT STATE VSM (APPENDIX 4) AND FUTURE VSM (APPENDIX 5)

The activities in the process of supply and distribution textbooks have been explained in Table 10 above. The current state VSM shows that activities undertaken by district offices are not adding value to the system, both when they receive and pass on the requisition forms, catalogues and school budgets to schools and when they receive and pass on the textbook requisitions to the Provincial Head office. The non-value adding activities are indicated by Data box 3 and 5 from Appendix 4. The information can be

delivered directly to schools via facsimile or e-mail or relevant electronic device and the schools can respond in the same way, refer to Appendix 5.

According to the LSM district office officer, the district office function is to distribute catalogues, requisition forms and book invoices between ECDoE and schools. Currently, this stage takes about 2 weeks in each cycle, accumulatively 4 weeks. Direct communication between Province and schools is encouraged by Toyota's rules 2 and 3 and can have the following benefits:

(a) the 4 weeks can be reduced to 5 days (1 week) maximum;
(b) reduced administrative burden in the district office;
(c) minimising possibility of parcels or submissions getting lost;
(d) ensuring direct receipt by both ECDoE and schools;
(e) creating relationships between the sender and recipient; and
(f) can save cost of posting and couriering the parcels.

The second notable time reduction is the data capturing and processing of the school requisitions in the provincial office. The Programme Manager of ECDoE LSM Unit said that the Department normally hires at least three data capturers for a period of 2 months. The data capturers are unemployed youths who sometimes are not computer literate or do not have typing skills. Information in the requisition forms is collated and captured to determine the required textbooks, the numbers and the schools that need those textbooks. Two months (8 weeks) was identified as the time that three persons took to capture the data from about 6000 schools. It takes around 2 hours to capture one school which is an excessively long time for a prepared tick box form for capturing. The time to capture can be halved to 1 hour maximum per school if the data capturers have typing skills. Therefore, it is proposed that data capturers be trained for administration skills, including faster typing speed in order to half the capturing time.

Another factor that impacts on the increased time is the late employment of data capturers. Data capturing takes place at nearly the same time every year, the beginning of July. Therefore the intake of temporary arrangement personnel could be planned timeously so that work can start immediately when schools' requisition forms are received from the 23 district offices. Therefore, 3 weeks could be saved in data

customer in the supply chain, thus the cycle time can be reduced. Cycle Time is the time required to complete one cycle of an operation. If cycle time for every operation in a complete process can be reduced to equal takt time, product can be made and delivered perfectly at the time required by the customer. The process cycle time in the current-state VSM is 30 weeks and future-state VSM is 23.6 weeks, which is a quantifiable time saving in the process.

Approximately 650 000 textbooks to secondary schools. are distributed per annum by ECDoE, (DoE, 2006)

$$\text{Current Process Cycle Time} = \frac{30\text{weeks X } 0.75\text{availability X } 8\text{hrs/day X } 5\text{days/week X } 60\text{ min/hr}}{6145\text{ schools (req)}}$$

Under the current regime, the cycle time is 8.79 minutes/requisition.

$$\text{Future Process Cycle Time} = \frac{23.6\text{weeks X } 0.75\text{availability X } 8\text{hrs/day X } 5\text{days/week X } 60\text{ min/hr}}{6145\text{ schools (req)}}$$

$$= 6.91 \text{ min/req}$$

Takt time is the pace of production to meet customer's requirements (Rother and Shook, 1999). Even though the Department's personnel process requisitions, what is delivered to the customer is a book. Therefore, in this case, takt time will be per book delivery. If implemented, the proposed improvement of the district office process results in the cycle time becoming 6.91 min/req which is about a 25% time process improvement. This means almost 25% of 7,5 months could be an effective saving of six weeks. The six weeks savings is substantial taking into consideration that the academic year is about 9.5 months.

$$\text{Takt time} = \frac{\text{available working time per period (minutes)}}{\text{Customer demand rate per period (units)}}$$

According to ECDoE annual report (2004) there are approximately 6145 schools in Eastern Cape public schools and require at least 4 additional textbooks per annum. Assumptions: 16 weeks in academic year to process intern administration, 3 administrators members, The 2003 Department of Public Service and Administration elucidate on the utilisation rate that allows for time that cannot be attributed to a specific project or work. This allows time for deduction of leave, sick leave, weekends and public holidays. In practice this means that an employee will be able to spend 75% of his or her time working.

$$\text{Takt time} = \frac{28\,800}{6145} = 4.68 \text{ min/req}$$

This illustrates a gap between the 4.68 min/req and 6.91 which means there is a 25% time saving required to meet customer needs. This is translated to about 4 weeks. The improvement from original 8.79 min/req, means a further improvement of about 40% (9 weeks) is required to meet the customer's need.

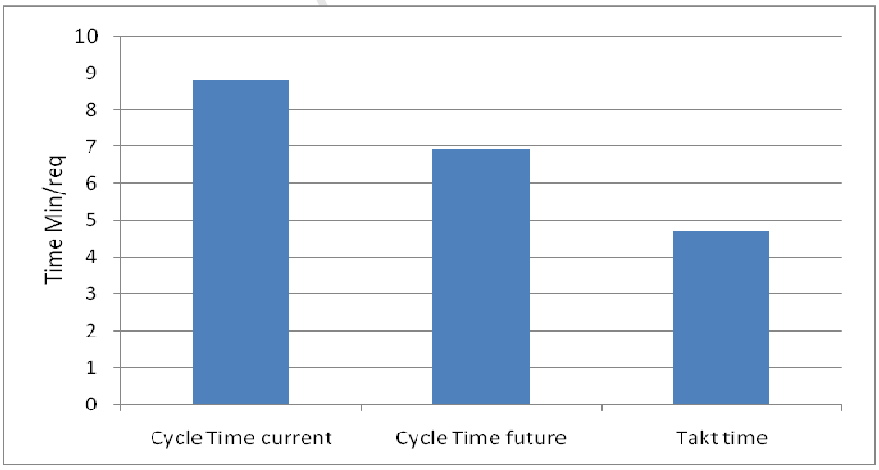


Figure 6: Showing cycle time vs Takt time

5.2.3 DELAY OF TEXTBOOKS AS MEASURED BY QUESTIONNAIRE

A random selection of secondary schools from the 2007 ECDoE address list were surveyed. The reason for choosing secondary schools is the ease in determining their

performance as Grade 12 results are published annually, hence easily accessible and quality of learners as test are nationally standardised. The schools that were measured were initially divided in three categories:

1. Township schools: predominantly black students and teachers;
2. Suburban schools: mostly White learners and teachers, former model c schools. All are in quintile 5; and
3. Rural schools: mixture of predominantly "Black" schools and, former model c schools with majority of White learners and teachers.

However, this was reviewed into two sections based on their historical background, former white (model c) and former black schools. As expected, the results from the surveyed schools show that the former model c schools have a higher Grade 12 pass rate than township schools, refer to Figure 7 below.

The results show that the former model c schools do not have learners without textbooks. Whereas for the surveyed black schools more than 40% of learners do not have textbooks.

About 60% of the surveyed schools indicated that Grade 11 is the least prioritised grade for obtaining textbooks, whereas 40% indicated Grade 10. All respondents agreed that Grade 12 is given preference in the allocation of textbooks or funds for textbooks.

The FFC (2005) report found that grades 10 to 12 have general shortage of textbooks, particularly in township and rural schools. In grade 11 it is caused by the abnormal repetition rates. Some of the reasons for the failure rate in grade 11 include the pressure on schools to produce high pass rates in grade 12. This results in the gate keeping of the learners, learners deciding not to write exams, and high drop out rates.

Almost half (50%) of the schools said the lack of textbooks has a negative impact on the Grade 12 pass rate and the other 50% said there was no evidence to suggest insufficient textbooks affects the pass rate. However, if all other variables remain constant, the schools with 40% or more of learners without textbooks showed lower Grade 12 pass rates with average of 55%. Figure 7 below shows that schools without textbooks have lower pass rates than those who have textbooks.

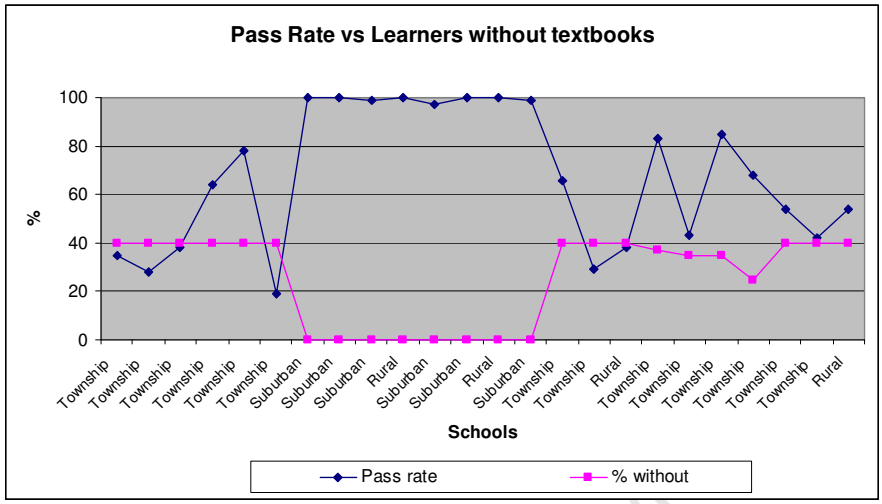


Figure 7: Graphical presentation of Grade 12 pass rate and learners without textbooks

According to Figure 7 above, the Grade 12 pass rate is influenced by the availability of textbooks in the surveyed schools. It is evident that schools with high number of learners without textbooks have lower pass rate compared to those where books are available. It is noted that there are many other factors that affect whether learners pass or perform better, however, it is clear that one of the important factors in improving the pass rate at secondary schools, particularly Grade 12, is to ensure that learners have the necessary textbooks. Figure 7 above also indicates that the location of a school does not play an important role in the availability of textbooks, however, what is noted is the historical category of the schools, refer to Figure 8 below. It is evident that former black only schools still lag behind the former model c or White only (suburban) schools with regards to the availability of textbooks and the achievement of Grade 12 passes. Figure 8 below depicts that location does not have that much impact, but the historical background of the school does.

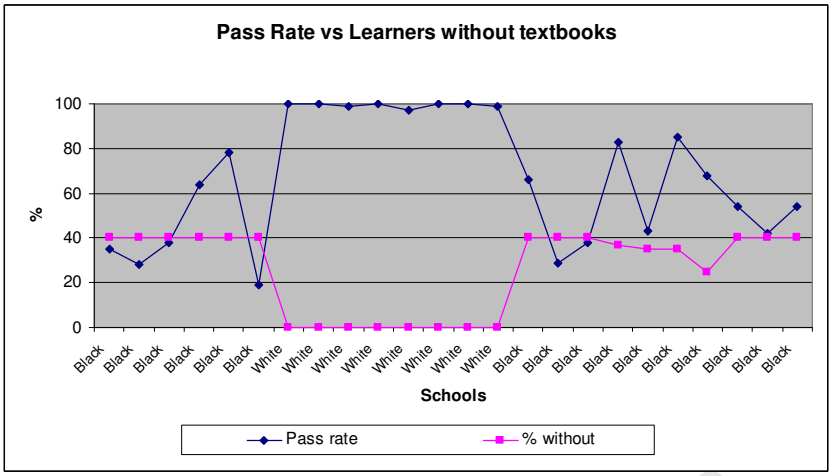


Figure 8: Showing pass rate and % learners without textbooks per historic school category

It is notable that almost all the surveyed schools are section 21, self-governing schools, and therefore they should have control over their budget. However, the former model c schools have control of their budget whilst the township schools' budgets are controlled by the ECDoE. The FFC (2005) attributes the lack of control by black schools to lack of principal's skills and confidence.

All of the surveyed schools said that they have a policy for the replacement of textbooks and the former model c (suburban) schools pointed out that the learners' parents were responsible for replacement if a textbook was lost or missing. The former black schools indicated that they attempt to recover the missing books from learners' parents, but ultimately the school is responsible for the retrieval rate which was less than 20% from FFC findings and KwaZulu Natal. These schools indicated that they are mostly not successful in their efforts and about 30% of the textbooks are lost per annum. This was confirmed by Qhebera Secondary school principal, that "if a parent said she or he is unable to pay due to unemployment, then the school would have to replace that textbook." While the ECDoE has an asset management policy in place, it is not enforced at school level (LSM Review Report, 2003). Schools can establish develop asset management policies against a set of guidelines produced by the ECDoE regarding the desired policy parameters and outcomes. These parameters should include amongst

others measures to keep up to date asset registers, learner accountability for textbooks and measures to address school security, including community involvement.

Almost all of the respondents revealed that textbooks can last at least three to five years. Losing a book before three years may lead to either the parents paying for replacement or the school. This is an opportunity cost that can be used in securing education related supplies other than textbooks or buy other textbooks, this can further reduce the shortage gap in township schools.

Each school is said to have a representative person responsible for the implementation policy, refer to Figure 9 below.

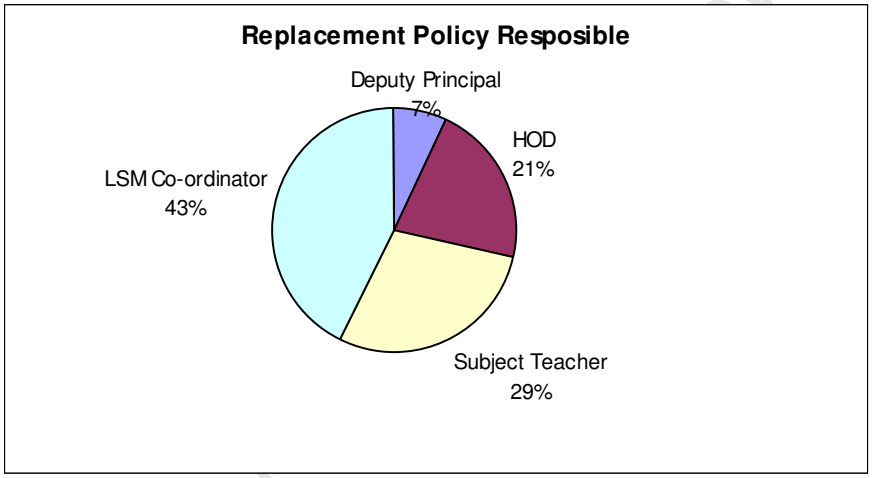


Figure 9: Persons responsible for textbooks replacement policy in schools

Figure 9 above indicates that most schools have LSM coordinators who are responsible for the replacement of textbooks. It was acknowledged that if the textbook replacement policy is weak or is not implemented effectively, then there would be further shortages of textbooks, particularly in black schools. It has been discovered that the school's representative is also responsible for filling-in the LSM order requisition forms from the Department. For the purpose of this research, it will not be discussed whether the filling of requisitions and replacement policy is best performed by LSM coordinators, Subject teachers, heads of department (HOD) or Deputy principals. However, it was noted that if there is a dedicated resource such as a LSM coordinator, there is a better chance to

recover books as they are not distracted by other work at school noted the principal of Lwandlekazi Secondary School.

One of the problems that was encountered was that the requisition forms for books arrive late at schools and are expected to be returned to the district office within one or two weeks. This could affect the processing of orders and may compromise the speed and accuracy of completing the requisition form, refer to Figure 10 below.

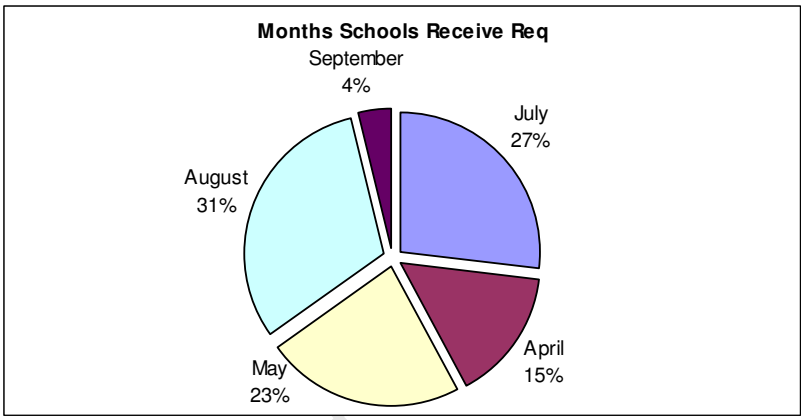


Figure 10: Time take in months which schools receive book requisitions forms

The bulk of the requisition forms arrive at schools in July and August and are scheduled to be in the Provincial DoE by the last week of the second term, mid-June. It is noticeable that no schools submitted in June as they may be busy with mid year examinations and the bulk of the month schools are closed. "Those that receive in August are very late, they need to be in the Head Office so that by the first day of the third term capturing and processing commences", according to the Programme Manager, LSM ECDoE.

The survey shows that over 90% of the requisition forms are returned to district offices within 2 weeks and are immediately sent to the Provincial office by the district office, see Figure 11 below. This late arrival of order forms has a ripple effect in the timing of the process, thus delays in delivery of books.

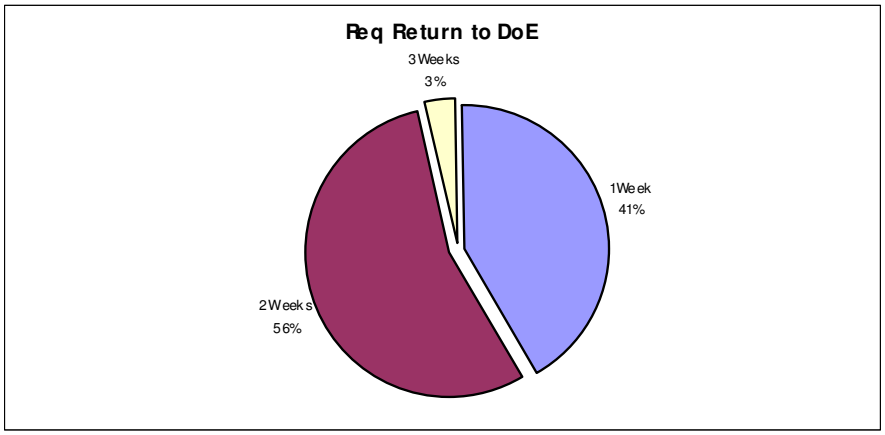


Figure 11: Shows the time (in weeks) that schools return requisitions to district office

As indicated in Chapter 2 and supported by LSM officer from the Port Elizabeth district office, the district office's duty is only to receive, collate and distribute requisition forms from schools to the provincial office for processing. Therefore, if the submissions are late it will delay the processing and this will probably lead to delays in the delivery of textbooks to schools.

Most (70%) former black schools indicated that they receive their complete textbook deliveries five months or more after the submission of requisition forms to the district office. These schools admitted that textbooks start arriving in early November but the last batch sometimes arrives in March/April the following year or sometimes not at all. This significantly contributes to the loss of teaching and learning time in the first quarter. Other schools indicated 3 - 4 months after the requisition submission, refer Figure 12 below. Even though there may be delays in delivery, all surveyed schools reflected that they receive the orders that had been requested in the requisition forms.

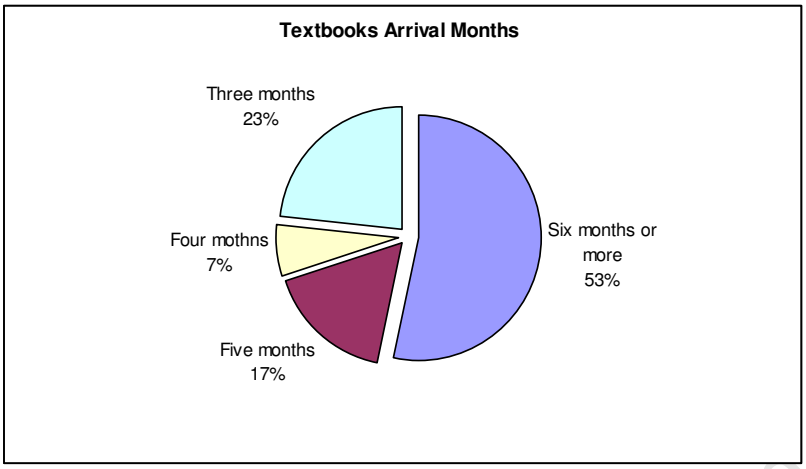


Figure 12: Time textbooks delivered after requisitions have been submitted

About 65% of respondents attributed the delay in the supply of textbooks to the Department, 21% to supplier/printer and others were non-responsive as they were not affected by the delays, refer to Figure 13 below.

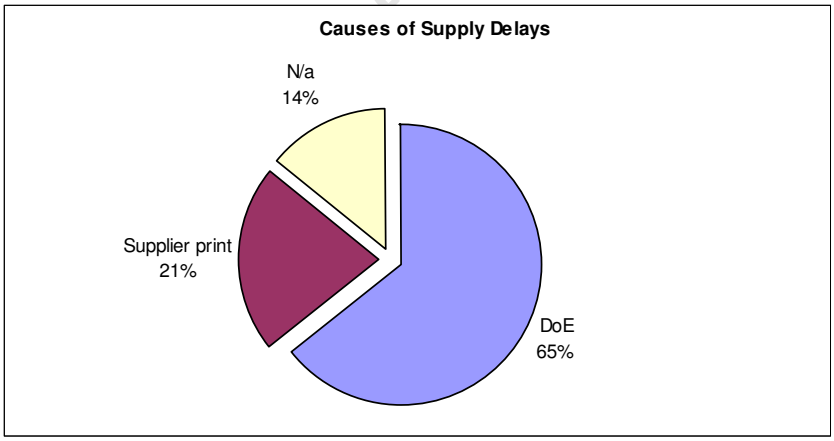


Figure 13: Identified causes of textbooks delivery delays

The 65% schools perceived the internal ECDoE operations to be too slow due to competency gaps, shortages of manpower and lack of planning. The assessment of these internal processes is the core reason for this study. The rest have attributed the delays to supplier printing. The printing delays were confirmed by what was the ECDoE Supply Chain officer expressing that there are only three major printing houses in South Africa.

All of these are located outside of the Eastern Cape and this sometimes affects the outcome of the print runs. According to the Programme Manager LSM ECDoE, some textbooks are not available in South Africa and have to be ordered from overseas suppliers, hence the delays. If the Department knows that some textbooks take longer, then it should make early/priority orders. 70% of the respondents noted that the delays in the supply of textbooks affect learning and teaching generally and 30% said they affect learning and teaching in the technical subjects. "The homework cannot be done because there is no reference material and classroom note taking takes away valuable learning time" said Loyiso Secondary School Principal.

Four factors, quantitative variables, were considered in the analysis of this study:

1. Time to return requisitions to the district office – The number of weeks that schools require to return their requisitions to the district office so that they reach provincial office for processing. Time to return to district office is an independent variable.
2. Pass rate – Grade 12 pass rate for 2007 for each surveyed school was considered. Pass rate is a dependent variable that is the result or outcome of other inputs.
3. Learners without textbooks – Percentage of learners without textbooks for one academic year, as measured at the end of the year. The percentage of learners without textbooks is an independent variable.
4. Time, number of months that it takes for textbooks to be delivered after schools have placed the order. The number of months for the delivery of textbooks is an independent variable.

Table 11: Computed descriptive statistics

Pass rate		*% learners without*		*Return to DO (weeks)*		*Deliver (months)*	
Mean	67.9	Mean	25.4	Mean	1.6	Mean	5.0
Standard Error	4.8	Standard Error	3.2	Standard Error	0.1	Standard Error	0.2
Median	67.0	Median	35.0	Median	2.0	Median	6.0
Mode	100.0	Mode	40.0	Mode	2.0	Mode	6.0
Standard Deviation	26.3	Standard Deviation	17.5	Standard Deviation	0.6	Standard Deviation	1.3
Sample Variance	692.9	Sample Variance	304.8	Sample Variance	0.3	Sample Variance	1.6
Kurtosis	-1.3	Kurtosis	-1.4	Kurtosis	-0.8	Kurtosis	-1.1
Skewness	-0.2	Skewness	-0.7	Skewness	0.3	Skewness	-0.8
Range	81.0	Range	40.0	Range	2.0	Range	3.0
Minimum	19.0	Minimum	0.0	Minimum	1.0	Minimum	3.0
Maximum	100.0	Maximum	40.0	Maximum	3.0	Maximum	6.0
Sum	2036.6	Sum	762.0	Sum	47.0	Sum	150.0
Count	30.0	Count	30.0	Count	30.0	Count	30.0

The computed descriptive analysis in Table 11 above indicates that the mean or average for the Grade 12 pass rate is 67%, with the minimum being 19 and the maximum being 100, illustrating a wide range in pass rate between surveyed schools. The range could be attributed to the gap between poor schools and wealthy ones.

The computed descriptive analysis indicates that the mean or average for return of requisitions to the district office is 1.5 weeks, with minimum being 1 and maximum 3. This confirms the findings in Figure 11.

The computed descriptive analysis for the surveyed schools indicates that the mean or average for learners without textbooks is almost 26%, with minimum being 0% and maximum more than 40% which is a wide range between the schools. As indicated, only former black schools have learners without textbooks.

The computed descriptive analysis for the surveyed schools indicates that the mean or average for delivery months is about 5 months, with minimum being 3 and upper limit being 6 months or more. The 5 months probably means that the schools receive their textbooks around mid-December, which should ensure that they are sorted when schools open for the next academic year. The 5 months is not an accurate average as 6 months or more was a category not a point figure. If schools and the Department could comply with the stipulated timelines such as two weeks to return requisitions to the district office and a delivery period of no more than 5 months, delays could be prevented and teaching and learning could be improved. Areas of improvement were also tested, refer to Figure 14 below.

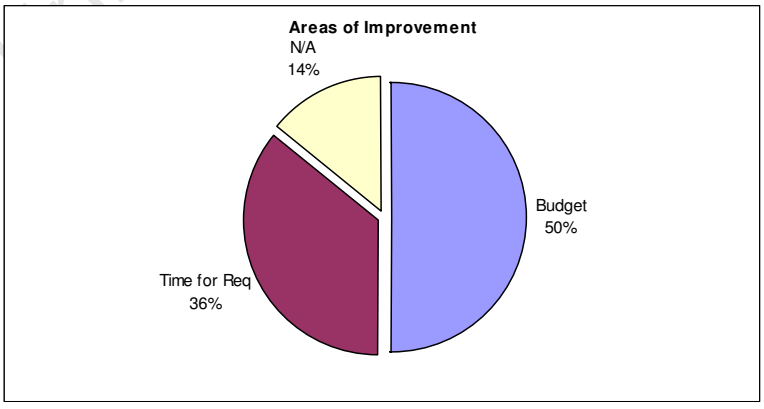


Figure 14: Shows proposed areas to improve shortage of textbooks

50% of the respondents mentioned that the improvement in the current shortage of textbooks could be attributed to the amount that ECDoE allocates for LSM. This low budget allocation leads almost directly to a shortage of textbooks. All respondents explained that they are not allowed to spend even a cent above the allocation. The FFC study noted that Grade 10 to12 textbooks cost is higher (R100 – R150) than that of primary grades. The shortage is worsened by the lack of budgeting or financial planning as textbooks supply requires multi-year planning. The LSM Review Report (2003) indicated that there is no medium term policy in place to finance LSM needs. Despite an overarching multi-year budgeting framework, the financing of LSM is done annually perpetuating the project or crisis mode of the process. The second challenge is for the Department to reduce the time (improve) for the requisitions to be submitted to schools. The requisitions' submissions are prepared by the Provincial office in Head Office, Zwelitsha.

14% of the respondents indicated that there is no need for improvements as all learners from former model c schools had textbooks at the beginning of the academic year. The wide range of minimum 0 to maximum 40 shows a clear gap between schools that are well resourced and those that are struggling. This study is not designed to measure shortages of textbooks but the supply of textbooks, however the process of supply could aggravate or improve the supply of textbooks and hence impact on shortages. For improvement in the process of provisioning of textbooks, the following was suggested by respondents, refer to Figure 15 below.

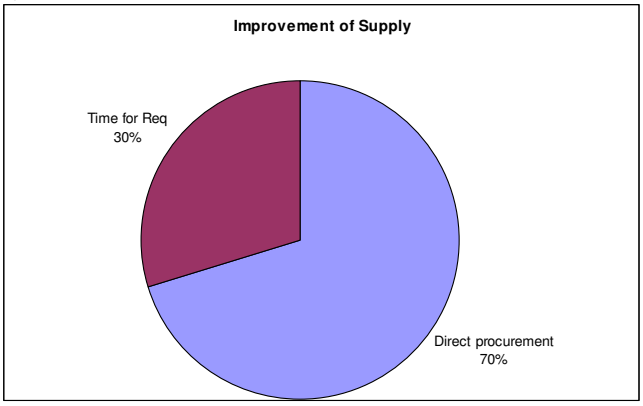


Figure 15: Proposed areas to improve supply of textbooks to schools

70% of the school respondents have suggested that the supply of textbooks can be improved by having a direct relationship between schools and publishers. This could mean that the responsibility for dealing with suppliers should be at school level, which is decentralization of either the choice of a textbook in the pre-approved list or the choice of publishers from an approved list. Since schools already receive forms with a pre-approved book list, therefore the direct relationship could be created with the suppliers. 30% of school respondents indicated that shortening the time that requisition forms take to get to the schools could improve the supply of textbooks, thus delivery to schools.

5.2.4 PEARSON COEFFICIENT OF CORRELATION

Correlation, often measured as a correlation coefficient, indicates the strength and direction of a linear relationship between two random variables. The closer the coefficient is to either −1 or +1, the stronger the correlation between the variables. If the variables are independent then the correlation is 0. The correlation coefficient does not reflect the causality of a relationship between variables as indicated in chapter 4. A correlation coefficient of at least 0.7 for social science research may be accepted as a good relationship between variables.

Spearman's rank correlation coefficient (*r)*, is a non-parametric measure of correlation that assesses how well an arbitrary monotonic function could describe the relationship between two variables, without making any assumptions about the frequency distribution of the variables.

Pass rate correlation

	Pass rate	*% without*	*Return to DO*
% without	-0.838968614		
Return to DO	0.295323879	-0.266908379	
Deliver (months)	-0.753649661	0.904878807	-0.337230302

Table 12: Showing computed Pearson Coefficient of Correlation

The computed coefficient of correlation between Grade 12 pass rate and learner without textbooks is -0.839. This shows a strong inverse correlation between a school's Grade

12 pass rate and learners without textbooks. The more learners that have textbooks, the higher the chances of passing Grade 12, refer to Figure 7 above.

From the surveyed schools, the 0.295 coefficient from Table 12 above shows that there is a weak correlation between the Grade 12 pass rate and the time it takes for schools to return the requisition forms to the district office. Schools are required to return them as soon as possible, within one or two weeks, but this shows no evidence of an impact on the Grade 12 pass rate. For the computed sample size, 0.30 would be the maximum practical significant correlation. For this study, the researcher was concerned with statistical significance. The -0.753 in Table 12 shows that there is a strong negative correlation (relationship) between the Grade 12 pass rate and the time, in months, that textbooks are delivered to schools. This may show that the 3 - 4 months delay in delivery is compromised for studies, homeworks, no study references for learners negatively affects the grade 12 pass rate.

From the surveyed schools, there is a weak correlation between percentage of learners without textbooks and time it takes for schools to return the requisition forms to district office. Table 12 above indicates that there is a weak correlation between the delivery month and the time it takes for schools to return the requisition forms to district office. However, the survey shows that there is a strong correlation 0.905 between the delivery month and the percentage of learners without textbooks. This could mean that the slower the delivery, the higher the number of students without textbooks. The number of learners without textbooks is a negative measure, the positive measure would be number of learners with textbooks.

5.2.5 PEARSON'S CHI-SQUARE TEST

Pearson's chi-square is used to test the independence of variables. A test of independence assesses whether paired observations on four variables, expressed in a contingency table, are independent of each other (Keller and Warrack, 2003). As indicated in Chapter 4, a chi-square probability of 0.05 or less is commonly interpreted

by applied workers as justification for rejecting the null hypothesis that the row variable is unrelated (that is, only randomly related) to the column variable. The alternate hypothesis is not rejected when the variables have an associated relationship, which is the case in this present study.

A Contingency Table was computed with the Grade 12 pass rate as a dependent variable and learners without textbooks, delivery time and time taken to return requisition forms to district office as independent variables.

Table 13: Contingency Table to compute chi-squared

Contingency Table

Pass Rate	*% without*	*Return to DO*	*Deliver (months)*	*TOTAL*
35	40	1	6	47
28	40	2	6	48
38	35	1	6	42
64	40	1	6	47
78	35	2	6	43
19	40	2	6	48
100	0	1	3	4
100	0	2	3	5
99	0	3	3	6
100	0	2	3	5
97	0	1	4	5
100	0	2	3	5
100	0	2	3	5
99	0	2	3	5
66	40	2	6	48
29	40	1	6	47
38	40	1	6	47
83	37	1	6	44
43	35	1	5	41
85	35	2	5	42
68	25	1	6	32
42	40	2	6	48
54	40	1	5	46
71	25	2	6	33
49	40	1	6	47
87	25	2	6	33
91	0	1	4	5
59	35	2	5	42
50	40	2	5	47
64	35	1	6	42
TOTAL	762	47	150	959

chi-squared Stat	218.442
df	58
p-value	0
chi-squared Critical	76.7778

The computed contingent table (Table 13 above) to determine the dependency of the variables showed p value = 0, which is less than 0.05. This means that the independent variables chosen, the number of learners without textbooks, time to deliver books to schools and time schools return requisitions to schools have an association with the Grade 12 pass rate.

The p-value is less that 0.05 which means that there is strong evidence to accept the research hypothesis. The three variables are independent of the pass rate which is the only dependent variable. This test was applied to illustrate that the Grade 12 pass rate is statistically dependent with the chosen independent variables.

5.2.6 REGRESSION AND ANOVA

Regression can be used for prediction, inference, hypothesis testing, and modeling of causal relationships (Mouton and Marais, 1996). These uses of regression rely heavily on the underlying assumptions being satisfied. In statistics, the coefficient of determination R^2 is the proportion of variability in a data set that is accounted (explained) for by a statistical model.

The general form, R^2 can be seen to be related to the explained portion of the variable, since the second term compares the unexplained variance (variance of the model's errors) with the total variance of the data. R^2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R^2 coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An R^2 of 1.0 indicates that the regression line fits the data perfectly.

ANOVA is a measure of categories. This analysis of variance allows researchers to compare several groups of observations, all of which are independent but possibly with a different mean for each group (Kim and Mueller, 1978). A test of great importance is whether or not all the means are equal.

SUMMARY OUTPUT - Regression and Anova

Regression Statistics	
Multiple R	0.843
R Square	0.710
Adjusted R Square	0.677
Standard Error	14.963
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	14273.953	4757.984	21.252	0.000
Residual	26	5821.038	223.886		
Total	29	20094.991			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	87.765	22.484	3.903	0.001
% without	-1.333	0.376	-3.550	0.001
Return to DO	3.919	5.217	0.751	0.459
Deliver (months)	1.570	5.330	0.295	0.771

Table 14: Showing combined Regression and ANOVA tests

R squared is 0.71 which means that 71% of the Grade 12 pass rate can be explained by the number of learners without textbooks, the time textbooks are delivered to schools and the time schools return requisitions to district office. The probability value indicated by significant f is less than 0.05. This means that there is strong evidence that dependent variable (intercept) can be explained by the independent variables. The computed pass rate regression model equation is

Pass Rate = 1.57*Delivery + 3.92*Return to District - 1.33*% Learners Without + 87.72

The computed ANOVA in Table 14 above indicates a probability value (p-value) of 0.001 for dependent variance (intercept) which is less that 0.05, hence statistically significant, thus the research hypothesis can be accepted. This indicates that the combined effect of the three independent variables have an impact on the Grade 12 pass rate.

The computed p-value for learners without textbooks is 0.001 which is less than 0.05, hence statistically significant, thus the research hypothesis can be accepted. This indicates that the number of learners without textbooks have an impact on the Grade 12 pass rate.

The computed p-value for the time (weeks) to return requisitions to district office is 0.459 which is above 0.05, hence statistically insignificant, thus there is evidence to reject the research hypothesis indicating that the time schools returns requisition forms has no impact on grade pass rate.

The computed p-value for the time (months) to deliver textbooks to schools is 0.771 which is above 0.05, hence statistically insignificant, thus there is evidence to reject the research hypothesis. The regression analysis shows 0.56 R square which is not a strong statistical indicator that the delivery time in months for textbooks after requisition forms have been submitted by schools can explain the Grade 12 pass rate, refer to Table 15 below.

Table 15: Regression and ANOVA Statistics for Pass rate and Delivery month

Pass Rate vs Delivery (month) Regression Statistics	
Multiple R	0.754
R Square	0.568
Adjusted R Square	0.553
Standard Error	17.608
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	11413.71018	11413.7102	36.8129861	1.52698E-06
Residual	28	8681.281211	310.045758		
Total	29	20094.99139			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	146.6471159	13.3730321	10.9658838	1.2103E-11
Deliver (months)	-15.75195652	2.596175103	-6.06737061	1.52698E-06

The computed p-value is 1.527 X 10^{-6} which is less than 0.05 hence statistically significant, this means that there is evidence to accept the research hypothesis. The time that textbooks are delivered to the surveyed schools has an impact on the Grade 12 pass rate. The p-value of 0.771 for delivery time in Table 14 above may be due to multi-collinearity because the delivery time and time schools return requisitions to Department are time measures and highly correlated, refer Table 12 above.

Table 16: Regression and ANOVA Statistics for Pass rate and Return of requisitions to district office

Pass Rate vs Return to DO Regression Statistics	
Multiple R	0.295323879
R Square	0.087216193
Adjusted R Square	0.054616772
Standard Error	25.59463025
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1752.608652	1752.608652	2.675390813	0.113103877
Residual	28	18342.38273	655.0850977		
Total	29	20094.99139			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	46.45711744	13.91024394	3.339777335	0.002384755
Return to DO	13.67886121	8.362888902	1.635662194	0.113103877

The computed R squared in Table 16 above for Grade 12 pass rate and return of requisitions by schools to district office is 0.087 which means that the time the schools return the requisition forms to the district office cannot explain the Grade 12 pass rate in the surveyed schools. The computed p-value for the time taken to return requisitions to district office is 0.113 which is greater than 0.05, this means the relationship is statistically not significant, thus there no evidence not to reject the research hypothesis.

Table 17: Regression and ANOVA Statistics for Pass rate and number of learners without textbooks

Pass Rate vs % Lernears Without Regression Statistics	
Multiple R	0.838968614
R Square	0.703868335
Adjusted R Square	0.693292204
Standard Error	14.5783147
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	14144.22812	14144.23	66.5525362	7.0085E-09
Residual	28	5950.763263	212.5273		
Total	29	20094.99139			

	Coefficients	*Standard Erroı*	*t Stat*	*P-value*
Intercept	100.0177874	4.753555414	21.04063	1.068E-18
% without	-1.264978505	0.155060379	-8.157974	7.00846E-09

R squared is 0.704 which means that the Grade 12 pass rate can be explained by the number of learners without textbooks. The p-value is 7.008 X 10^{-9} which is less than

0.05 hence statistically significant, this means that there is strong evidence to accept the research hypothesis. The number of learners without textbooks in the surveyed schools has a negative impact on the Grade 12 pass rate.

5.2.7 VALIDITY OF THE REGRESSION MODEL AND ANOVA TOOLS

The regression model is statistically valid if the sum of residual (measure of error) is equal to zero and the fitted model follows the actual, see Figure 16 and 17 respectively.

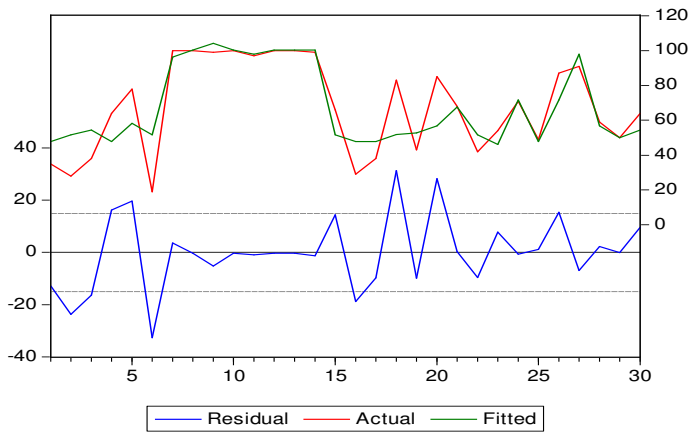


Figure 16: Showing zero effect of residual

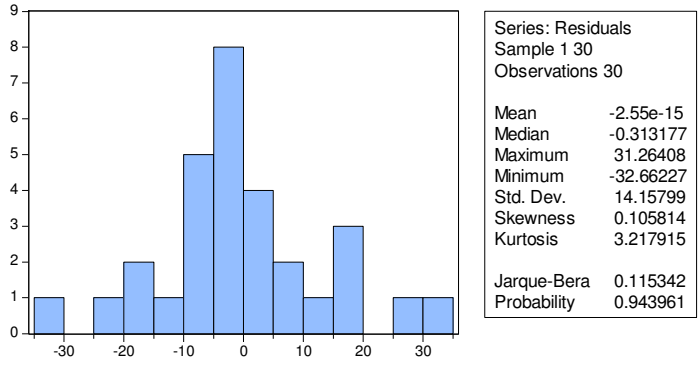


Figure 17: Showing Jarque-Bera normal distribution test

Figure 16 above shows the zero net effect of the residual. According to the Jarque Bera test the computed regression model is valid because it is normally distributed and the p-value is above 0.05 which indicates statistical significance, refer to Figure 17. The Kurtisos is close to 3 which also supports the normal distribution of data, refer to the histogram above, Figure 17. The normal distribution also indicates that the number of observations (viz. 30) is statistically significant to measure the sample as a representative of the population.

The computed Anderson-Darling test also supports the normal distribution of the data, thus validating the use of the model, Table 18 below.

Empirical Distribution Test for RESID01
Hypothesis: Normal
Date: 06/11/08 Time: 14:55
Sample: 1 30
Included observations: 30

Method	Value	Adj. Value	Probability
Lilliefors (D)	0.137060	NA	> 0.1
Cramer-von Mises (W2)	0.106404	0.108177	0.0869
Watson (U2)	0.105839	0.107603	0.0691
Anderson-Darling (A2)	0.502933	0.516764	0.1897

Method: Maximum Likelihood - d.f. corrected (Exact Solution)

Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-1.89E-15	2.584884	-7.33E-16	1.0000
SIGMA	14.15799	1.859035	8.795773	0.0000

Log likelihood	-121.5765	Mean dependent var.	-2.55E-15
No. of Coefficients	2	S.D. dependent var.	14.15799

Table 18: Anderson-Darling model to test normal distribution of data

To further validate the model, autocorrelation was tested. The term auto-correlation may be defined as "correlation between members of a series of observations ordered in time or space. A valid regression model assumes that the disturbance term (error) relating to observation is not influenced by the disturbance term relating to any other observation" (Gujarati, 2003).

Table 19: Breusch-Godfrey Serial to test auto-correlation

F-statistic	1.191968	Prob. F(2,24)	0.3210
Obs*R-squared	2.710668	Prob. Chi-Square(2)	0.2579

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/12/08 Time: 15:16
Sample: 1 30
Included observations: 30
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEL	0.836755	5.542306	0.150976	0.8813
RD	1.880361	5.317767	0.353600	0.7267
WI	-0.014115	0.390001	-0.036191	0.9714
C	-6.928755	23.24433	-0.298084	0.7682
RESID(-1)	-0.269765	0.208639	-1.292972	0.2083
RESID(-2)	-0.224950	0.208746	-1.077626	0.2919

R-squared	0.090356	Mean dependent var	-2.55E-15
Adjusted R-squared	-0.099154	S.D. dependent var	14.15799
S.E. of regression	14.84331	Akaike info criterion	8.409833
Sum squared resid	5287.775	Schwarz criterion	8.690072
Log likelihood	-120.1475	Hannan-Quinn criter.	8.499484
F-statistic	0.476787	Durbin-Watson stat	1.868713
Prob(F-statistic)	0.789907		

Table 20: Durbin-Watson to test auto-correlation

Dependent Variable: PR
Method: Least Squares
Date: 06/11/08 Time: 14:07
Sample: 1 30
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEL	1.578670	5.326193	0.296398	0.7693
RD	3.930372	5.213433	0.753893	0.4577
WI	-1.334673	0.375338	-3.555927	0.0015
C	87.71642	22.46849	3.903974	0.0006

R-squared	0.710874	Mean dependent var	67.86667
Adjusted R-squared	0.677513	S.D. dependent var	26.33044
S.E. of regression	14.95251	Akaike info criterion	8.371201
Sum squared resid	5813.013	Schwarz criterion	8.558027
Log likelihood	-121.5680	Hannan-Quinn criter.	8.430968
F-statistic	21.30873	Durbin-Watson stat	2.365722
Prob(F-statistic)	0.000000		

Two statistical tools were applied to assess the auto-correlation. The Breusch-Godfrey Serial Correlation test indicates a probability value of 0.321 which is greater than 0.05, hence statistically insignificant, thus supporting the research hypothesis, refer to Table 19 above. This suggests that the regression model is not influenced by the disturbance term. Table 20 above indicates that there is no auto-correlation and the model is not influenced by a disturbance term (error). The Durbin-Watson test confirms that there is no auto-correlation as Durbin-Watson stat is 2.365. If the Durbin-Watson stat is around 2, then there is no auto-correlation (Guyarati, 2003).

5.3 SUMMARY

Chapter 5 illustrates the findings of the study. This has been shown by the developed model to measure the degree of decentralization in the process of the provision of textbooks to schools. The qualitative developed model has illustrated that the activities from decision making and execution largely take place in the Head Office. Thus, illustrating that it is fairly centralized. This opens an opportunity to advance decentralization to districts and schools. For instance, after an approved book list from province, ordering and payment of required textbooks could be done in the district office. This would improve speed as the district office is closer to the publishers.

The study has illustrated that VSM and lean thinking can be successfully applied to identify waste in the process, thus improvements can be proposed. In this study this can contribute to 25% time recovery.

The statistical analysis indicated that the availability of textbooks to learners is positively related to their pass rate. The surveyed schools suggested that mainly black schools are affected by shortage of books, thus their pass rate. The surveyed schools have illustrated that shortage of textbooks is not entirely attributed to the inefficient process but also to budget allocation. For instance, an average per learner expenditure in KwaZulu-Natal, was only R35 in 2005/6 fiscal year and R33 in the EC. This is a far cry from the legislated R100 minimum. Chapter 6 will conclude on the major findings to illustrate root causes for the inefficient process and propose where greater interventions can be made.

CHAPTER 6 – CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

It is evident from the findings above that the South African Schools Act (SASA), National Standards and Funding Norms (NSFM) and LSM Review Report in ECDoE (2003) policies embarked by the Department from 1998 have had limited effect on the provisioning of textbooks. Most decisions regarding this activity still reside with the central government. The decision making table developed in this study has been utilized to measure the Department's functions in the process of supplying textbooks to public schools. The tabular model that has been developed has two arrays, the rows reflect supply activities, actions and information that need to be taken or conveyed in order to connect the process of provisioning. The columns in the model represented functions, where the decision making or execution of the activity takes place. There are 15 broad activities in the process of supply of books to schools as identified during interviews and supported by LSM Review Report, 2003.

The results show that decision making for the choice of textbooks, the list of suppliers to be used, the process to be followed for the procurement of textbooks, all illustrate that the Schools Act, Norms for Funding and decentralization implemented in 1998 and 1999 respectively have not been transferred adequately to promote efficient supply process. The Provincial department continues to prescribe even for Section 21 schools. From this, it can be deduced that the control of the process of supply is still very centralized. The surveyed schools indicated one of the delays (bottlenecks) in the process was the fact everything is done by the Province. About 70% of schools indicated that a direct relationship, possibly even a procurement relationship, with the suppliers can save time and money in the full supply chain from school to district office to provincial office, refer to Figure 13 above.

The lack of transfer of power from Provincial cannot be taken in isolation of the organizational dynamics and the reason for undertaking institutional structure change in 1999. The 1999 Imbewu Decentralization Report indicates that the financial crisis in 1997 in the Eastern Cape Government necessitated the system change, thus decentralization of financial

management and control (Cole, 1999). The report indicated that the department over-spent in 1996/7 and continuing strongly into 1997/8 by nearly R 1 billion which it is still struggling to repay. As indicated in Chapter 2 above that the sequence of deployment of functions has a direct impact on the outcomes of the process. The justification for ECDoE to undertake decentralization is in accordance with what Falleti (2004) suggested, the central Head Office prefers administrative decentralization (policy control) to fiscal decentralization, which in turn is preferred to political decentralization (A>F>P). The rationale for this sequence is that the central government seeks to divest itself of expenditure responsibilities. The main goal of the central authority is to cut Head Office expenditure through the downward transfer of responsibilities.

For instance in 2004 schools and district offices still lacked human resources capacity, trained person in supply chain management, and office resources such as computers and ICT systems, office buildings and materials (ECDoE, 2006). This has played a role in limited activities and decisions being transferred to district offices and to schools.

If central government is forced to choose between surrendering fiscal or political authority, it will choose to give away fiscal authority and to retain political control, which may serve to influence the expenditure decisions made by sub-national officials. The same reasoning applies to explain the reverse order of preferences of sub-national government (P>F>A). If the Head office does not control the appointment and removal of local actors, they can push forward the issues and concerns of their territorial units without fear of retaliation from above (Garman et al, 2001). If district directors and school principals have to choose between fiscal and administrative decentralization, they will choose the transfer of fiscal authority, particularly if the unions representing the public sectors to be decentralized through administrative decentralization are large and strong. In other words, sub-national executives prefer political autonomy, money and responsibilities and this has led to successful implementation of decentralization Falleti (2004):

Political ⟶ Fiscal ⟶ Administrative

The tabular model developed to assess functions has revealed that all fiscal responsibilities related to LSM expenditure as still provincial office responsibility, from procurement of

suppliers, book selection, purchasing of books, budget allocation and payment of suppliers. The analysis of this thesis supported by Imbewu Report, 1999 that shows the effective implementation of decentralization could end with the following main points:

1. systems work best when they operate as close to the delivery as possible;
2. implementation should be high priority and attention be given to different steps and tasks that are needed to build an effective financial management system that is connected to the Province, district and schools; and
3. capacity building is an essential component particularly at local level.

The direct relationship proposed by schools supports the decentralization of either the choice of textbooks from an approved book list or choice of suppliers from an approved list. The choice from the book list and/or the supplier list would assist schools and suppliers to meet local needs as they are better aware of them. The approved books list ensures curriculum consistence, thus quality of learners. Since the Department already distributes approved book list in schools as reflected in requisition forms, therefore supplier list is the only aspect relevant for discussion. The approved supplier list should ensure economies of scale, thus achieving discounts from suppliers. The approved supplier list further ensures the implementation of procurement legislation such as PFMA and PPPFA. Therefore, the choice of supplier by a school from the supplier list in decentralization of the process of supplying textbooks is proposed and the schools have indicated that it can improve (streamline) the process.

The results above show that Lean Thinking philosophies such as the 5 protocols of TPS and VSM can be employed in a service environment to identify non-value add or *muda* in the process of supplying textbooks to schools in the Eastern Cape. The application of Lean Thinking rules can improve the process by the following:

- Specifying the exact next customer in the chain. It is not enough to indentify the district office as being the next in the chain but who is responsible in the district office to prevent delays and safeguard against requisition forms being missing and getting lost.
- Creation of a response mechanism that ensures that information or material has been received by the correct person. This will encourage the next activity in the chain to be activated.

- Further, the highlighted 25% reduction in time is strong evidence to answer this study research question and can be achieved in three areas. Under the current regime, the takt time is 8.79 minutes per requisition.
- When implemented, the proposed improvement of cutting out the district office in the process results in the takt time becoming 6.91. Activities in the district office do not add value in the supply of textbooks as they only distribute information and material.
- The reduction in time from 8 weeks to 2 weeks could be achieved by schools and ECDoE communicating directly.
- The lack of computers and e-mail facilities within Eastern Cape schools clearly aggravated the situation.
- The stage of capturing and processing data could be halved from 2 months to a month by employing the temporary personnel on time and giving preference to those that are computer literate or have typing skills. If the three administration personnel can be permanent employees of the ECDoE, this could build the required skills, enhance institutional memory and thus achieve continuous improvement.

Section 3.5 above stipulates 8 types of waste in Lean Thinking. The waste identified in this study are classified as inappropriate processing if untrained data captures take excessive time, transportation waste for information unnecessarily move via district office and waiting waste for waiting for data capturers to be appointed.

The current drawn VSM for provisioning of textbooks can be used both for information and material process flow, refer to Appendix 4. There is strong evidence to suggest that TPS, a manufacturing tool, can be applied in a service industry such as education service delivery. This claim is also supported by Spear and Bowen (1999), who state that for any productive work that has outcomes for a customer, lean philosophy can be used.

It is noted that the drawn VSM reveals the process flow procedures and that role clarification and direct communication between schools and Province needs to be encouraged. The VSM has also shown that the process is still controlled from the provincial office and is thus still centralized to a large extent. Schonberger (1996), in the 5th customer-focused principle suggests cutting out wasteful areas to increase "time-to-market and quick-response

management. Finally it can be seen and proven that the VSM and lean five principles can be used for the following:

- to describe the process of supplying textbooks within the ECDoE public schools;
- to clarify the material and information flow to the role players, namely Administrators in Head Office, Zwelitsha, district offices and schools in the supply and distribution of textbooks;
- to identify non-value adding activities (waste), and based on the findings recommend improvements; and
- can contribute to the improvement in the supply of textbooks to EC public schools, as measured by reduced time in the system.

There is statistical evidence from the surveyed schools that the delivery time and availability of textbooks to learners is impacting the Grade 12 pass rate. However, there is no statistical evidence that the time taken for the schools to return the requisitions to the district office has an impact on the Grade 12 pass rate. The sample from secondary schools was small as it represented 3% of the population, however it meets the ANOVA and Regression test conditions. Hence the sample can be used to infer to the population, secondary schools in the EC. This means that the sample findings and conclusions can be used to refer to the 852 secondary schools in the Eastern Cape.

Basically the Toyota Production System (TPS) is intended to provide a system for creating thinking people, who seek continuous improvement through eliminating waste and thus creating value for the customer. This is achieved by adhering to the five rules. Different tools can be employed to implement the five rules such as 4Ms, 5 whys and VSM which were utilised in this study.
It is evident from the findings that learners with textbooks have higher chances of passing grade 12 than those without. Further in some schools, textbook management systems such as issue and asset registers are inadequate or non-existent and this needs improvement.

With so much political will by the Government of the Eastern Cape to deliver a democratic and egalitarian education to its citizens, it is clear that a few aspects of the current situation

need to be challenged. The first is the effectiveness and efficiency of the system that was aspired to; if decentralization has worked when measured against pre-set goals. The second is the development of policy and procedures for supplying textbooks which will include identification of role players and their functions, timelines and triggers, multi-year planning and budgeting, formulation of direct or proper reporting channels.

6.2 RECOMMENDATIONS

It cannot be over emphasised that the pass rate of schools is strongly associated with the availability of textbooks in school. This is one of the indicators that are viewed as whether the Department is successful or failing in delivering sustainable education system to its citizens.

The sequencing and structure of the textbook supply chain of evaluation and selection, ordering and procurement of service providers and delivery and payment, proposed by LSM 2003 Review Report is a sound system and the current poor performance is due to the uncoordinated and late management of that structure. The process should be properly documented and not be driven by personal preferences and personal experiences. This supports TPS rule 1 that all work should be highly specified as to content, sequence, timing and outcome. Throughout the textbook supply chain, a number of options can be considered which should improve the process.

1 The schools should be allowed to make the choice of textbooks from approved list, budget discretion, appoint publishers from approved list. Within a curriculum environment, schools get to choose their LSM and secondly, in terms of Section 21 of the Schools Act, the LSM budget is determined down at school level and schools get increasing discretion over their own choices within the LSM budget and this needs to be enhanced particularly in black schools. The ECDoE could send the approved supplier list to schools.

2 Multi-year planning and budgeting: the LSM supply chain is currently treated as an annual project instead of being taken as an ongoing, year-round, multi-year rolling activity as it deserves.

3 There is currently not sufficient clarity on roles and responsibilities in the supply chain (LSM Review Report, 2003). Functions in the chain can be divided between Head Office, district level and school level responsibilities. At particularly head office and district level, the supply chain management functions can be outsourced, while others, such as the

determination of evaluation parameters, are core educational functions and should be kept in-house (ECDoE, 2007).

4 The LSM unit is headed by a Programme Manager and there is no directorate. This indicates requirement for higher level leadership and low level of coordination between the chief directorate 'silos' for transversal projects, such as LSM supply, is exacerbated by the lack of a central control point of accountability for LSM (LSM Review Report, 2003). Over the years the ECDoE appointed a LSM manager several times with more than this portfolio to fulfill, causing LSM to fall by the wayside more often than not. The appointments were often at an insufficient hierarchical level to ensure compliance with proposed timelines for the supply of textbooks with other Directorate. The result is that there is insufficient integration for LSM supply, insufficient pressure for timely decisions and actions and insufficient oversight and monitoring of compliance across the department with the critical path of the supply chain. Thus, lack of leadership at Directorate level was identified as one of the key enablers in the process of provisioning of textbooks. Establishment of a directorate would assist in determining budgets and personnel requirements particularly administrative for the capturing and processing of requisitions.

5 Outsource to an implementing agent: After a comparison with other provincial education departments, the KwaZulu-Natal Provincial education, as stipulated in Chapter 3 above, decided to outsource the service to two managing agents that will enable the tracking and tracing of deliveries. As from 2005, two companies EduSolutions and Indiza Motswedi were responsible for the procurement and delivery of textbooks and stationery in KwaZulu-Natal under the close supervision of the Education Department. Their functions were largely administrative and logistical, mainly ordering, sorting, packaging and storing of books and stationery, capturing of requisitions, checking and correcting placements of orders and constantly reporting on the delivery system. Distribution was to be undertaken by local SMMEs.

The new integrated system allows the Department to manage orders and deliveries and for the first time the Department knows exactly how many books a school has ordered and received, which will assist officials to check orders against the enrolment of learners in schools.

The two companies buy books and stationery directly from publishers and manufacturers on behalf of the Department. This also ensures that all discounts obtained from the publishers will flow back into the LSM budget, which in turn will enable the Department to buy more books for redress. Therefore outsourcing of LSM has yielded positive results in other provinces such as KwaZulu-Natal. The outsourcing would also ensure that the LSM system is not taken as project, but a multi-year and continuous activity that requires budgeting. Outsourcing and an option to manage the LSM supply chain can be informed by three objectives:

- Effective and efficient service delivery to end users namely schools;
- Encourage implementation of PFMA and PPPFA, without compromising education content and delays;
- Long-term sustainability; and
- Optimal utilisation of limited resources.

6 Enhance and streamline procurement process. There could be early appointments of suppliers which a list could be sent to schools. For instance the education department in the Western Cape does not invite tenders for the supply of LSM. Instead it has a contract with a preferred supplier as per section 38 of the PFMA (Public Finance Management Act, 1999). This contract allows booksellers and publishers to register with the department. Schools identify their suppliers from the lists and negotiate a discount on the publisher's price with the respective booksellers. Booksellers then deliver textbooks and stationery to the schools directly. The delivery of textbooks and stationery to schools is both the booksellers' and publishers' responsibility.

6.3 FURTHER STUDIES

The prioritization of non-value activities (waste) that were identified in the drawn current VSM and future-state VSM was not established in order to systemically improve less efficient areas in the process. A further study can draw the future state VSM that indicates weighting or sequence of importance.

The study has only been supported by factual information from secondary schools, it is proposed that it be extended to primary and combined schools. That study could also test if the pass rates of learners from other grades are impacted by the availability of textbooks to learners.

The assessment was limited to activities within the ECDoE system even though it is impacted and influenced by other stakeholders such as PASA. Thus, any future study can include the whole supply chain.

The developed tabular model is a qualitative tool and could be refined to be quantitative as well. For instance, an activity in the process and identified variables could be allocated numerical points (weights) such that a functionality threshold is determined to measure the degree of decentralization.

Organizational dynamics in the ECDoE and its impact in the process of supplying textbooks has not been fully explored in this study. Also, the context of this study is the Eastern Cape Province and this can be extended to the other eight Provinces in South Africa.

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APPENDICES

APPENDIX 1 - TEXT BOOK SUPPLY IN THE DEPARTMENT OF EDUCATION

Dear Mr Zibi

I am Siyabonga Simayi, a student at the University of Cape Town undertaking a research study focusing on management capacity in education system of the Eastern Cape. Management capacity has been identified as one of challenges affecting service delivery. Within the Eastern Cape Department of Education (ECDoE) a process of textbook supply will be measured as it affects the learning and teaching at schools. Please refer to the attached letter by Professor Thomas Koelble for more information on the project. I am hoping that doing some 'baseline' analysis utilizing lean management analysis will help identify success initiates, ineffective areas, thus recommend improvements.

I am requesting that you take time, not more than 20 minutes, to provide input in the questions provided and send the completed spreadsheet to siyabonga.simayi@coega.co.za or fax 041 585 5445 for analysis preferably by 2 November 2007. **Not all questions are compulsory**. Please note that your answers are confidential and the survey is anonymous and can only be used by the University.

Thanking you in advance for your cooperation.

Siyabonga Simayi
UCT Student Number: smysiy001
Telephone: 041 507 9085

Please provide the following information about yourself. Tick where appropriate	
How long have you worked for DoE?	
Hierarchical level	
Town or physical location of your office/school	

Type of job (educator, admin official, etc)	

1. Who is responsible for the supply of text books in schools within the Eastern Cape?

Suppliers/Publishers	DoE, Province	District Office	Schools	DoE, National

2. Who is responsible for the policy development of the supply of school text books?

Suppliers/Publishers	DoE, Province	District Office	Schools	DoE, National

3. Who is mandated to monitor the implementation of the policy/procedure for the supply of textbooks in schools?

DoE, Province	District Office	Schools	DoE, National	Suppliers

4. Who is responsible for the text books budget in your department/school?

DoE, Province	District Office	School	DoE, National	Department of Finance

5. Where is the textbook budget reside?

DoE, Province	District Office	School	DoE, National	Department of Finance

6. Who is responsible for the appointment of publishers/suppliers?

DoE, Province	District Office	School	DoE, National	Department of Finance

7. What is the criterion for selecting a supplier/publisher?

8. Who submits a textbook request to the DoE?

DoE, Province	District Office	Schools	Scheduled	Suppliers

9. What is the average frequency of requests for the supply of textbooks from a Township school?

Once in a year	Once in two years	Once in three years	Once in five years	Once in ten years

10. What is the average frequency of requests for the supply of textbooks from a rural school?

Once in a year	Once in two years	Once in three years	Once in five years	Once in ten years

11. What is the average frequency of requests for the supply of textbooks from a suburban (ex-Model C) school?

Once in a year	Once in two years	Once in three years	Once in five years	Once in ten years

12. What is the procedure for ordering/buying textbooks?

13. What triggers the ordering of textbooks?

Increase in the number of learners	Loss of textbooks	Change in syllabus/curriculum	Wear and tear	Other

14. When is the need for the text books identified?

Begin of each year	End of each years	Every term	Once a year	Once in three years

15. Who identifies the need?

DoE, Province	District Office	Schools	DoE, National	Scheduled

16. Is the need for textbooks supply related to the number of learners?

Yes	No

17. Name suppliers/publishers that are currently used by the department to supply textbooks?

_____

_____

_____

18. When do the suppliers get paid?

After 30 days	Subject to delivery in the DoE	Subject to the delivery at school	When supplier indicates readiness	After order submitted to the supplier

19. What is the average time given to the suppliers to deliver 1000 textbooks after the submission of the purchase order?

1 - 2 weeks	3 – 5 weeks	6 – 9 weeks	More than 10 weeks	Other (Specify)

20. Where do the suppliers/publishers deliver textbooks?

DoE, Province	District Office	Schools	DoE, National	Other (Specify)

21. Where are the most delays for receiving text textbooks from suppliers?

Payment of supplier	District Office space (readiness)	ECDoE space (readiness)	Transportation problems	Suppliers printing

22. Where are the delays for delivering textbooks to schools?

Payment of supplier	District Office space (readiness)	ECDoE space (readiness)	Transportation/ distribution problems	Suppliers printing

23. Which schools suffer the most from the delay?

Rural	Township	Suburban (ex-Models C)	Farm	Coloured/Indian

24. What is the average learning/teaching time, per annum, lost by schools due to textbooks supply delays?

1 - 2 weeks	3 – 5 weeks	6 – 9 weeks	More than 10 weeks	Other

25. In your view, how does the late supply of textbooks affect learning?

_____

_____

_____

26. How does the department ensure that schools do not loose textbooks?

Policy development and implementation	School keep the books	Learner penalty if book is lost	Learner to replace lost property	Other

27. How do schools ensure that learners do not loose textbooks?

Locker system	School keep the books	Learner penalty if book is lost	Learner to replace lost property	Other

28. Who has the ultimate mandate for ordering and supply of textbooks?

DoE, Province	District Office	Schools	DoE, National	SGB

29. What can be done to improve supply of textbooks in schools?

APPENDIX 2 - TEXT BOOK SUPPLY IN THE DEPARTMENT OF EDUCATION SURVEY

Dear Principal

I am Siyabonga Simayi, a student at the University of Cape Town undertaking a research study focusing on management capacity in education system of the Eastern Cape. Management capacity has been identified as one of challenges affecting service delivery. Within the Eastern Cape Department of Education (ECDoE) a process of textbook supply will be measured as it affects the learning and teaching at schools. Please refer to the attached letter by Professor Thomas Koelble for more information on the project. I am hoping that doing some 'baseline' analysis utilizing lean management analysis will help identify success initiates, ineffective areas, thus recommend improvements.

I am requesting that you take time, not more than 20 minutes, to provide input in the questions provided and send the completed spreadsheet to siyabonga.simayi@coega.co.za or fax 041 403 0401 for analysis preferably by not later than 2 June 2008. **Not all questions are compulsory**. Please note that your answers are confidential and the survey is anonymous and can only be used by the University.

Thanking you in advance for your cooperation.

Siyabonga Simayi
UCT Student Number: smysiy001
Telephone: 041 403 0486
Fax 041 403 0401

Please provide the following information about yourself. Tick where appropriate	
How many learners are in your school?	
How many teachers are in your school?	
Type of school, section 21 or non-section 21	
What is the quintile of your school?	
Where is the location of the school? (Is it rural, township or suburban)	
What is the average budget for LSM in the past three years?	

What is the pass rate in Grade 12?	

1. What is number (or %) of learners without textbooks?

0 - 9%	10 – 19%	20 – 29%	30 – 39%	40% and more

2. Which Grades are mostly affected by lack of textbooks?

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12

3. Which Grades get preference in the supply of textbooks?

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12

4. Does the absence of textbooks have effect on Grade 12 success rate? If yes please explain.

Yes	No

_____

_____

5. Who is responsible for the budget of textbooks in your school?

DoE, Province	District Office	School management	SGB	Other (specify)

6. Does your school have retention or replacement plan for textbooks? If yes please explain

Yes	No

_____

_____

7. Who is mandated to monitor the implementation of the retention and replacement plan in your school?

Class Teacher	Subject Teacher	Principal	H.O.D	LTSM coordinator

8. How many years do textbooks last?

1 Year	2 Years	3 Years	4 Years	5 Years or more

9. When does your school receive book catalogue?

March	April	May	July	August

10. When does your school return the catalogue after date of receipt?

1 Week	2 Weeks	3 Weeks	4 Weeks	5 Weeks or more

11. Who is responsible for filling-in the catalogue?

Class Teacher	Subject Teacher	Principal	H.O.D	Other (specify)

12. When does your school receive textbook requisitions?

March	April	May	July	August

13. When does your school return the requisitions after date of receipt?

1 Week	2 Weeks	3 Weeks	4 Weeks	5 Weeks or more

14. Who is responsible for filling-in requisitions in your school?

Class Teacher	Subject Teacher	Principal	H.O.D	LTSM coordinator

15. When do publishers (book suppliers) deliver the ordered textbooks after the submission of the requisition(s)?

1 Month	2 Months	3 Months	4 Months	6 Months or more

16. Do publishers deliver the textbooks as submitted in the requisition?

All the time	80% of the time	70% of the time	60% of the time	50% of the time or less

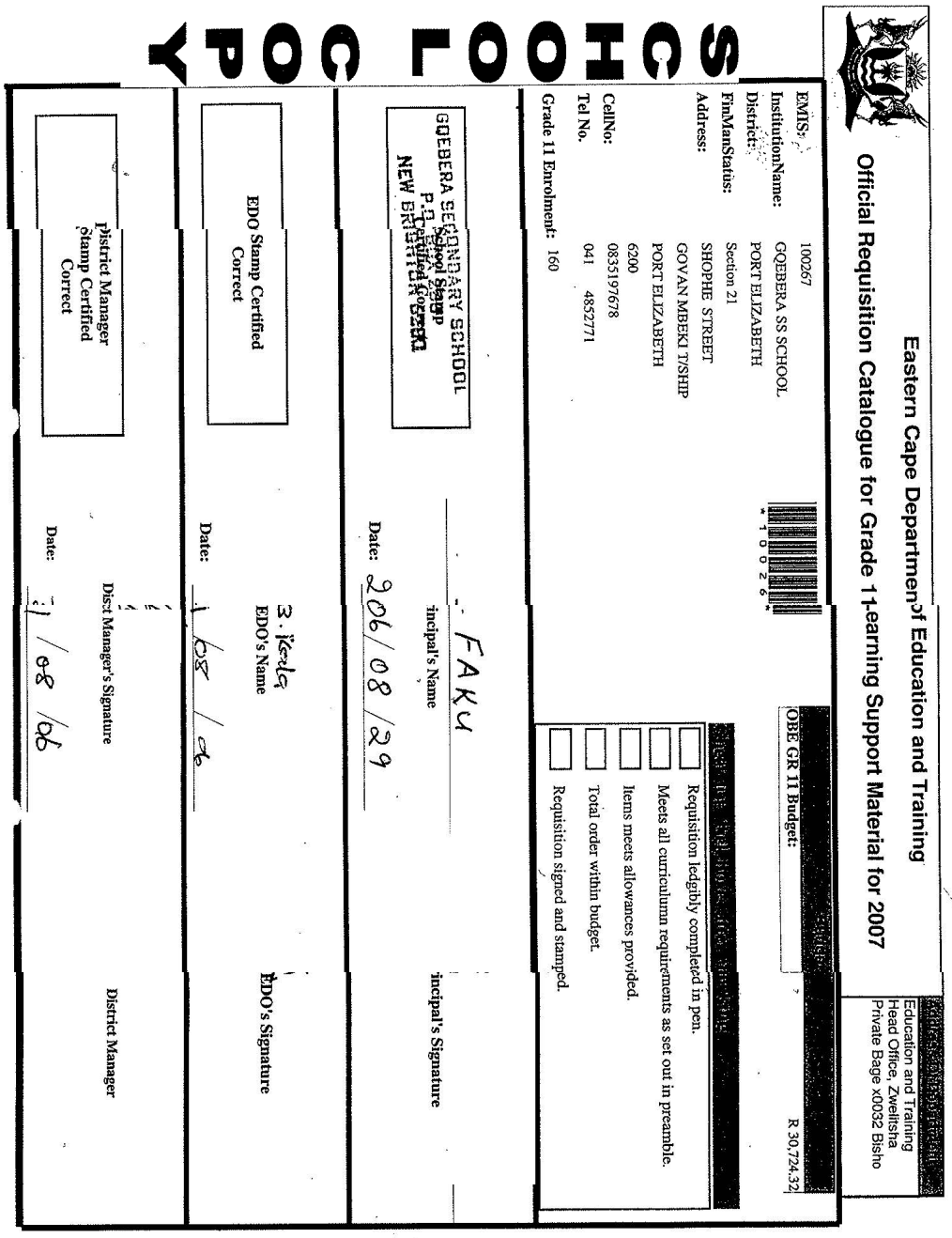
17. Where do most delays occur in receiving textbooks from suppliers?

Schools	District Office	ECDoE (province)	Transportation problems	Supplier printing

18. In your view, how does the late supply of textbooks affect learning?

19. What can be done to improve supply of textbooks in your school?

APPENDIX 3 – REQUISITION FORMS



Eastern Cape Department of Education and Training

Official Requisition Catalogue for Grade 11-earning Support Material for 2007

Education and Training
Head Office, Zwelitsha
Private Bage x0032 Bisho

EMIS: 100267
InstitutionName: GQEBERA SS SCHOOL
District: PORT ELIZABETH
FinManStatus: Section 21
Address: SHOPHE STREET
GOVAN MBEKI T/SHIP
PORT ELIZABETH
6200
CellNo: 0835197678
Tel No. 041 4852771
Grade 11 Enrolment: 160

OBE GR 11 Budget: R 30,724.32

- Requisition legibly completed in pen.
- Meets all curriculum requirements as set out in preamble.
- Items meets allowances provided.
- Total order within budget.
- Requisition signed and stamped.

SCHOOL STAMP

GQEBERA SECONDARY SCHOOL
P.O. Box
NEW BRIGHTON

Principal's Name: FAKU
Principal's Signature
Date: 06/08/29

EDO Stamp Certified Correct

EDO's Name: Z. Kerdy
EDO's Signature
Date: 1/08/06

District Manager Stamp Certified Correct

Dist Manager's Signature
District Manager
Date: 1/08/06

POOR COPY

Title of Material	Publisher	Component	Qty Allowed	Catalogue Number	Price	Quantity Required	Total Value
Dictionary of Science and Technology	Horizon Books: A & C Black	Supplimentary Resource Material		07213HO01	R 149.95		
Real-World Technology Resistant Materials - Second Edition	Horizon Books: Collins Educational	Supplimentary Resource Material		07213HO02	R 228.00		
Complete Technology and Design 2nd Edition	Hodder Murray	Supplimentary Resource Material		07213HS01	R 240.00		
Graded Exercises in Technical Drawing	Maskew Miller Longman	Learner's Book (Supplementary Material)		07213MM68	R 155.06		
Advanced Design and Technology	Maskew Miller Longman	Learner's Book (Supplementary Material)		07213MM69	R 451.06		
Technical Drawing 1 Plane and Solid Geometry	Maskew Miller Longman	Learner's Book (Supplementary Material)		07213MM70	R 155.06		
Technical Drawing 2 Mechanical Drawing	Maskew Miller Longman	Learner's Book (Supplementary Material)		07213MM71	R 139.06		
Technical Drawing 3 Building Drawing	Maskew Miller Longman	Learner's Book (Supplementary Material)		07213MM72	R 122.06		
PART B: RESOURCE MATERIALS	CONTENT SUBJECTS:	DRAMATIC ARTS				XHOSA	
Umdlalo: Isikhokelo sohlalutyo	Van Schaik Publishers	Learner's textbook		12313VS04	R 99.95		
PART B: RESOURCE MATERIALS	CONTENT SUBJECTS:	HISTORY				XHOSA	
They Fought for Freedom: Nelson Mandela (IsiXhosa Version)	Maskew Miller Longman	Supplementary Reader		13313MM49	R 52.20		
PART B: RESOURCE MATERIALS	CONTENT SUBJECTS:	LIFE ORIENTATION				XHOSA	
Ukulungiselela Imeko	New Africa Education	Resource Material: Facilitator's		13713NF04	R 71.50		
Multilingual Explanatory Maths Dictionary (Gr. 8-12)	Clever Books (Pty) Ltd	Additional resources that support the learner's textbook		13713CL01	R 79.95		
Multilingual Explanatory Science Dictionary (Gr. 8-12)	Clever Books (Pty) Ltd	Additional resources that support the learner's textbook		13713CL03	R 79.95		
					TOTAL ORDER VALUE =		R 30666.50

PROVINCE OF THE EASTERN CAPE

DEPARTMENT OF EDUCATION
ISEBE LEZEMFUNDO
DEPARTEMENT VAN ONDERWYS
Private Bag X0032, Bhisho, South Africa

The Principal
GQEBERA SS SCHOOL
PORT ELIZABETH

EMIS: 100267
CIRCUIT: CIRCUIT 3

21 April 2007

Dear Sir or Madam

FINAL FUNDING NORMS PAPER BUDGETS 2007/2008

You have been placed in Quintile 5 of the Resource Target Model for 2007. Schools in quintile 1 and 2 have been declared "No Fee" schools for 2007.

Your placement in the table was determined by the use of poverty data at ward level, as calculated by Statistics South Africa. Various factors were included in the calculation of the Index of Deprivation of the community that surrounds your school. The domains that were used are:

1.Income and material deprivation
2.Employment deprivation
3. ...lth deprivation
4. ...cation deprivation
5.Living environment deprivation

It is very important to note that the physical condition of your school was not considered for the calculation of the Index of Deprivation.

The same learner totals that were used to calculate your post establishment for 2007 were also used to calculate your paper budgets for 2007. Learner totals from schools that benefit from the Grant in Aid scheme will differ from the post establishments. Your learner details are as follows:

Grade	R	1	2	3	4	5	6	7	8	9	10	11	12	LSEN	Total
Enrolment	0	0	0	0	0	0	0	0	85	149	121	149	94	0	598

Your indicative budget for 2007 is:

ITEM	TOTAL	
SCHOOL STATIONERY	R5,310.24	12 % of total
LEARNING AND TEACHING SUPPORT MATERIAL (LTSM)	R19,913.40	45 % of total
CASH PAYMENT / OTHER	R 4,425.20	10 % of total
EDUCATION CONSUMABLES	R 4,425.20	10 % of total
N EDUCATION CONSUMABLES	R2,212.60	5 % of total
MAINTENANCE	R3,540.16	8 % of total
MUNICIPAL SERVICES	R4,425.20	10 % of total
GRAND TOTAL	R44,252.00	

Circular 10 of 2007:
Circular 10 of 2007 gives guidelines on budget allocations to schools. Principals are to ensure that they are in posession of the circular to ensure adequate planning.

Contestations:
Schools that have submitted contestations on their placement will recieve the outcome of their appeal shortly.

Yours in Education

Mrs. T. Cumming
Chief Financial Officer

Technical enquiries on placement can be directed to:
Mr R van Rensburg, EMIS. Tel: 043-7351820. Fax: 043-7351993

DISTRICT PORT ELIZABETH
CIRCUIT: 3

PROVINCE OF THE EASTERN CAPE

DEPARTMENT OF EDUCATION
ISEBE LEZEMFUNDO
DEPARTEMENT VAN ONDERWYS
Private Bag X0032, Bhisho, South Africa

The Principal
GQEBERA SS SCHOOL
PORT ELIZABETH

EMIS: 100267
CIRCUIT: 3

4 APRIL 2006

Dear Sir or Madam

FINAL FUNDING NORMS PAPER BUDGETS 2006/2007

u have been placed in Quintile 5 of the Resource Target Model for 2006.

Your indicative budget for 2006 is:

Breakdown of Budget:

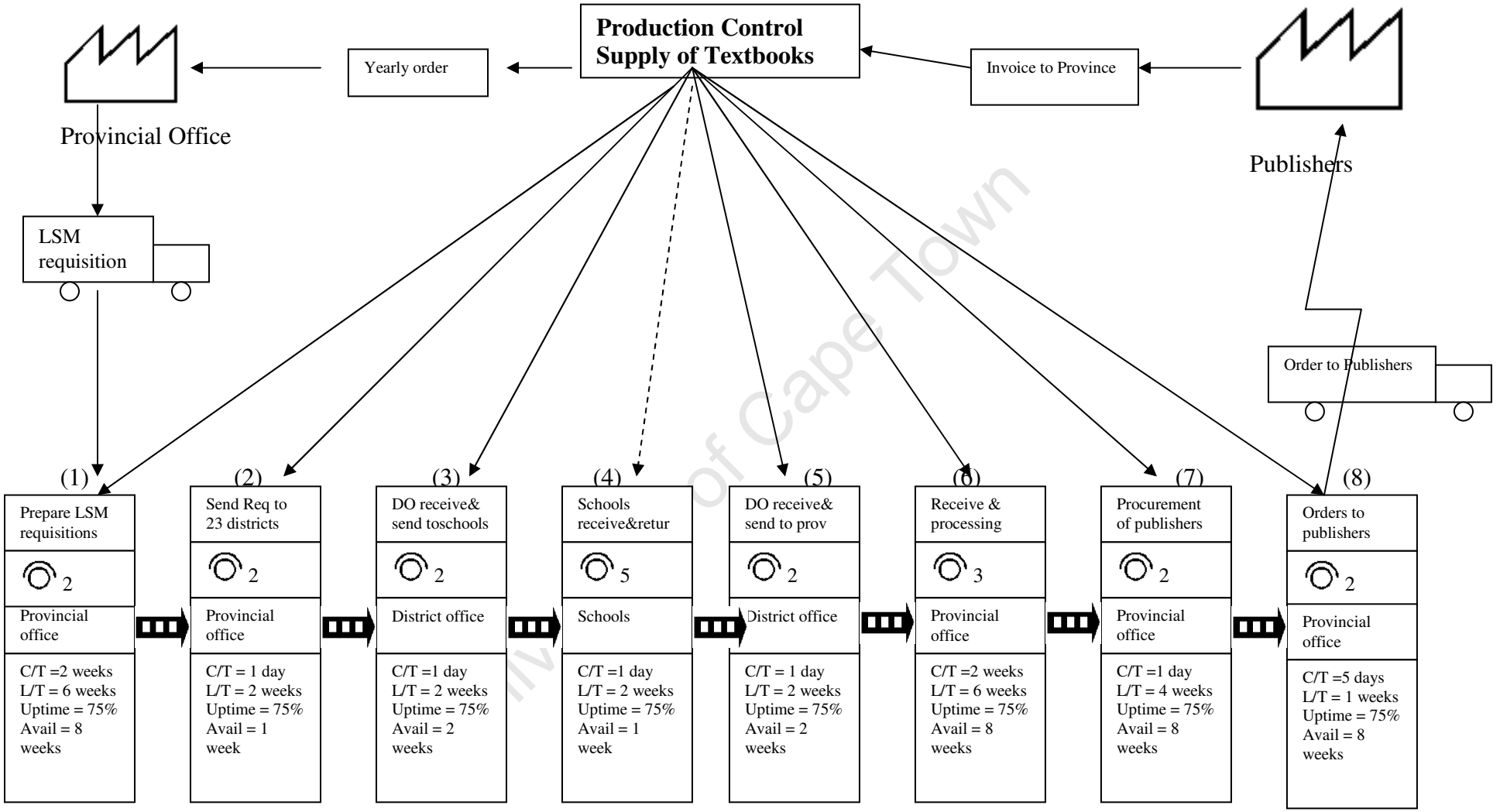
ITEM	Primary	Secondary	Total
School Stationery	R0.00	R5,119.97	R5,119.97
OBE Material (Grade R – 7) Top – up	R0.00	R 0.00	R0.00
LSM Grade 8 (Textbooks, Literature & OBE)	R 0.00	R25,739.94	R25,739.94
LSM Grade 9 (Textbooks, Literature & OBE)	R 0.00	R18,371.67	R18,371.67
LSM Grade 11 (Textbooks, Literature & OBE)	R 0.00	R30,724.32	R30,724.32
OBE Material Grade 12	R 0.00	R 0.00	R 0.00
..books & Literature (Gr 12)	R 0.00	R 0.00	R 0.00
OBE Material (Gr 10)	R 0.00	R2,719.79	R2,719.79
Educational Consumables	R0.00	R2,320.16	R2,320.16
Non-Educational Consumables	R0.00	R1,225.18	R1,225.18
Maintenance	See line total	See line total	R4,065.96
Municipal Services	R0.00	R4,585.72	R4,585.72
Total			R94,872.72

Yours in Education

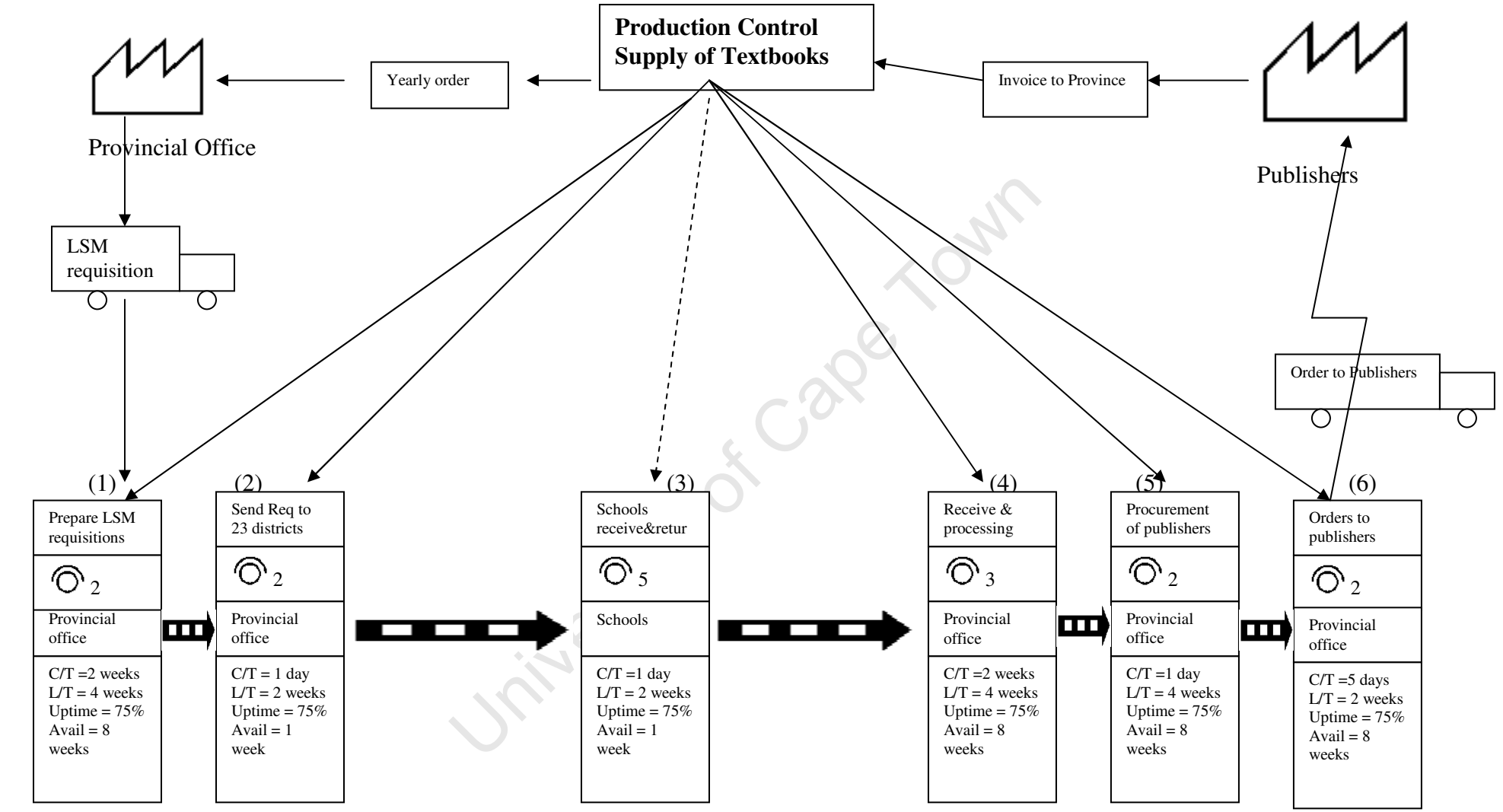
Mrs. T. Cumming
Chief Financial Officer

Technical enquiries can be directed to:
Mr R van Rensburg, EMIS, Tel: 043-7351820, Fax: 043-7351993

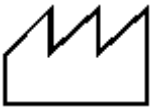
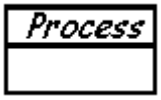
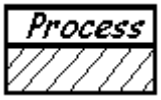
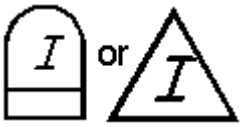
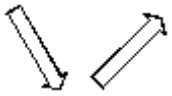
APPENDIX 4 - CURRENT VSM

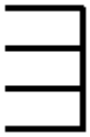
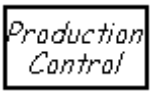
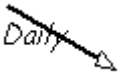
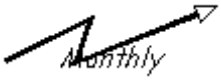


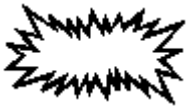
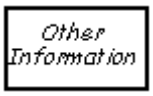
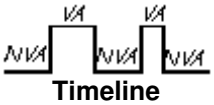
APPENDIX 5 - REVISED VSM (IMPROVED)



APPENDIX 6 - VALUE STREAM MAPPING SYMBOLS

 **Customer/Supplier**	This icon represents the Supplier when in the upper left, the usual starting point for material flow. The customer is represented when placed in the upper right, the usual end point for material flow.
 **Dedicated Process**	This icon is a process, operation, machine or department, through which material flows. Typically, to avoid unwieldy mapping of every single processing step, it represents one department with a continuous, internal fixed flow path. In the case of assembly with several connected workstations, even if some WIP inventory accumulates between machines (or stations), the entire line would show as a single box. If there are separate operations, where one is disconnected from the next, inventory between and batch transfers, then use multiple boxes.
 **Shared Process**	This is a process operation, department or workcenter that other value stream families share. Estimate the number of operators required for the Value Stream being mapped, not the number of operators required for processing all products.
 **Data Box**	This icon goes under other icons that have significant information/data required for analyzing and observing the system. Typical information placed in a Data Box underneath FACTORY icons is the frequency of shipping during any shift, material handling information, transfer batch size, demand quantity per period, etc. Typical information in a Data Box underneath MANUFACTURING PROCESS icons: □ C/T (Cycle Time) - time (in seconds) that elapses between one part coming off the process to the next part coming off, □ C/O (Changeover Time) - time to switch from producing one product on the process to another □ Uptime- percentage time that the machine is available for processing □ EPE (a measure of production rate/s) - Acronym stands for "Every Part Every___". □ Number of operators - use OPERATOR icon inside process boxes □ Number of product variations □ Available Capacity □ Scrap rate □ Transfer batch size (based on process batch size and material transfer rate)
 **Workcell**	This symbol indicates that multiple processes are integrated in a manufacturing workcell. such cells usually process a limited family of similar products or a single product. Product moves from process step to process step in small batches or single pieces.
 **Inventory**	These icons show inventory between two processes. While mapping the current state, the amount of inventory can be approximated by a quick count, and that amount is noted beneath the triangle. If there is more than one inventory accumulation, use an icon for each. This icon also represents storage for raw materials and finished goods.
 **Shipments**	This icon represents movement of raw materials from suppliers to the Receiving dock/s of the factory. Or, the movement of finished goods from the Shipping dock/s of the factory to the customers

 **Push Arrow**	This icon represents the □pushing□ of material from one process to the next process. Push means that a process produces something regardless of the immediate needs of the downstream process.
 **Supermarket**	This is an inventory □supermarket□ (kanban stockpoint). Like a supermarket, a small inventory is available and one or more downstream customers come to the supermarket to pick out what they need. The upstream workcenter then replenishes stocks as required. When continuous flow is impractical, and the upstream process must operate in batch mode, a supermarket reduces overproduction and limits total inventory.
 **Material Pull**	Supermarkets connect to downstream processes with this "Pull" icon that indicates physical removal.
 **Safety Stock**	This icon represents an inventory □hedge□ (or safety stock) against problems such as downtime, to protect the system against sudden fluctuations in customer orders or system failures. Notice that the icon is closed on all sides. It is intended as a temporary, not a permanent storage of stock; thus; there should be a clearly-stated management policy on when such inventory should be used.
 **External Shipment**	Shipments from suppliers or to customers using external transport.
 **Production Control**	This box represents a central production scheduling or control department, person or operation.
 **Manual Info**	A straight, thin arrow shows general flow of information from memos, reports, or conversation. Frequency and other notes may be relevant.
 **Electronic Info**	This wiggle arrow represents electronic flow such as electronic data interchange (EDI), the Internet, Intranets, LANs (local area network), WANs (wide area network). You may indicate the frequency of information/data interchange, the type of media used ex. fax, phone, etc. and the type of data exchanged.
 **Production Kanban**	This icon triggers production of a pre-defined number of parts. It signals a supplying process to provide parts to a downstream process.
 **Withdrawal Kanban**	This icon represents a card or device that instructs a material handler to transfer parts from a supermarket to the receiving process. The material handler (or operator) goes to the supermarket and withdraws the necessary items.

 **Signal Kanban**	This icon is used whenever the on-hand inventory levels in the supermarket between two processes drops to a trigger or minimum point. When a Triangle Kanban arrives at a supplying process, it signals a changeover and production of a predetermined batch size of the part noted on the Kanban. It is also referred as □one-per-batch□ kanban.
 **Kanban Post**	A location where kanban signals reside for pickup. Often used with two-card systems to exchange withdrawal and production kanban.
 **Sequenced Pull**	This icon represents a pull system that gives instruction to subassembly processes to produce a predetermined type and quantity of product, typically one unit, without using a supermarket.
 **Load Leveling**	This icon is a tool to batch kanbans in order to level the production volume and mix over a period of time
 **MRP/ERP**	Scheduling using MRP/ERP or other centralized systems.
 **Go See**	Gathering of information through visual means.
 **Verbal Information**	This icon represents verbal or personal information flow.
 **Kaizen Burst**	These icons are used to highlight improvement needs and plan kaizen workshops at specific processes that are critical to achieving the Future State Map of the value stream.
 **Operator**	This icon represents an operator. It shows the number of operators required to process the VSM family at a particular workstation.
 **Other**	Other useful or potentially useful information.
 **Timeline**	The timeline shows value added times (Cycle Times) and non-value added (wait) times. Use this to calculate Lead Time and Total Cycle Time.

Source: www.lean.org, Lean Enterprise Institute: Brookline.

APPENDIX 7

13 Mbaba Street
KwaDwesi
Port Elizabeth
6201

07 May 2007

The Head of Department
Eastern Cape Department of Education
Private Bag X0032
Zwelitsha

Dear Ms Nomlamli Mahanjana

I hereby request permission to conduct a study at the Eastern Cape Department of Education (ECDoE). I have enrolled with the University of Cape Town, Graduate School of Business for Management Science studies.

My research interest is on the delivery of education within the Eastern Cape, with a focus on the management of the supply of textbooks to schools. The study will use lean management tool to measure the supply of textbooks process from the identification if the need up to the supply at the gate of the school. This study will further measure the realistic impact of textbook supply to learning and teaching, bottlenecks in the process, key delay areas and success areas, thereafter recommend areas of improvement.

I am convinced that the research will bring about awareness to the management of the ECDoE in delivering quality education particularly textbooks to the schools within the Eastern Cape.

Attached to this request letter, is the University of Cape Town consent form and the letter of consent from my supervisor Professor Thomas Koelble.

Yours faithfully

Siyabonga Simayi (Mr.)
Student Number: smysiy001
Telephone Number: 041 507 9086
Fax: 041 585 5445
Email Address: siyabonga.simayi@coega.co.za

Breakwater Campus | Portswood Road | Greenpoint
University of Cape Town | Private Bag X3
Rondebosch | 7701 | Cape Town | South Africa
Tel: +27 (0) 21 406 1999
Fax: +27 (0) 21 406 1412
E-mail: tkoelble@gsb.uct.ac.za

September 14, 2006

To Whom It May Concern,

This letter serves to identify that Zandile Gubeni, Siyabonga Simayi and Sumetee Pahwa-Gajjar are currently research students at the University of Cape Town, Graduate School of Business. They are engaged in research funded by the National Research Foundation (NRF) in Pretoria. The research deals with the issue of 'service delivery' to identify ways in which service delivery in education and electrification can be improved across the country. The research investigates nine Eastern and Western Cape municipalities. It involves statistical research as well as interviews and conversations with councillors and key administrators in local government. The research project is supervised and devised by myself, Professor Thomas Koelble. I am also the recipient of the NRF award to conduct the research and have the ultimate responsibility for the project. I would very much appreciate your cooperation in this project as it is designed to help alleviate poverty in the country and therefore si supported so generously by the NRF.

Should you have any further questions, please do not hesitate to contact me at 021-406-1999 or my email at tkoelble@gsb.uct.ac.za.

With best regards,

Prof. Thomas Koelble
Graduate School of Business
University of Cape Town

APPENDIX 8 – COMMERCE FACULTY ETHICS IN RESEARCH COMMITTEE

UNIVERSITY OF CAPE TOWN

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form. The completed form should be submitted to departmental Ethics Committee representatives for submission to the Commerce Faculty Ethics in Research Committee

1. PROJECT DETAILS	
Project title:	
Principal Researcher/s:	**Research Supervisor / Co-researchers:**
E-Mail Address:	
Brief description of the project:	
Research methods and procedure: **(please tick and explain procedure)** □ **Interviews** □ **Survey questionnaire** □ **Experiment** □ **Secondary data** □ **Observation** □ **Other (please specify):**	
2. PARTICIPANTS	

Characteristics of participants:

Gender:
Race /
Ethnicity:
Age range:
Location:
Other:

Affiliations of participants: **(please tick)**

□ **Company employees** □ **Hospital employees** □ **General public** □ **Military staff** □ **Farm workers** □ **Students** □ **Other (specify)**

If your sample includes learners (aged 15 and below), mentally incompetent persons, or legally restricted groups please explain on a separate page why it is necessary to use these particular groups

3. ORGANISATIONAL PERMISSION

If your research is being conducted within a specific organisation, please state how organisational permission will be obtained:

4. INFORMED CONSENT

What type of consent will be obtained from study participants?

Oral consent
Written consent
Anonymous survey questionnaire (covering letter required, no consent form needed)
Other (specify): _____

How and where will consent/permission be recorded?

If subjects are minors or mentally incompetent, describe on a separate page how and by whom permission will be granted?

5. CONFIDENTIALITY OF DATA

What precautions will be taken to safeguard identifiable records of individuals? Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run. This question also applies if you are using secondary sources of data.

6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? (tick one)

□ **Yes** □ **No**

If yes, answer the following questions on a separate page:
Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks
Outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study
Outline whether and why you feel that the value of information to be gained outweighs the risks

7. intended dissemination of research findings

Have you discussed authorship issues with your co-researchers or supervisor? (tick one)

□ **Yes** □ **No**

If yes, what did you agree?

PLEASE ATTACH THE FOLLOWING DOCUMENTS TO YOUR APPLICATION

A full copy of the research proposal
Any consent form that will be signed by the participants or read to them (if any)

Any interview schedules, cover letters, forms, instruction sheets, survey questionnaires or other material that will be used in the study.

I certify that that the material contained herein is truthful and that all co-researchers and supervisors are aware of the contents thereof:

Applicant's signature: _____ Date: _____

For Ethics committee representative only **Recommendation:** **Signature:** **Date:**
For Ethics committee CHAIRPERSON only **Recommendation:** **Signature:** **Date:**