A GENERIC APPROACH TO INTEGRATED LOGISTIC SUPPORT FOR WHOLE-LIFE WHOLE-SYSTEMS

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DECLARATION

I declare that the thesis, that I hereby submit for the degree Philosophiae Doctor (Engineering) at the University of Pretoria, is my own work and has not been previously submitted by me for a degree at another University.

Petrus Johannes Pretorius
ABSTRACT

A generic approach to integrated logistic support for whole-life whole-systems

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Degree: Philosophiae Doctor (Industrial Engineering)

Definitions for logistics are numerous. Logistics is furthermore divisionalised amongst functional lines as well as industry lines. Therefore one hears about military logistics, business logistics, marketing logistics, engineering logistics, logistics relating to e-commerce and some more. Within the various professional disciplines and societies the viewpoints differ even more than the definitions. The reason for this confusion when it comes to defining and understanding logistics is because of the way in which logistics is functionalised. With all these different functional focusses the emphasis tends to be on detailed logistics solutions often causing sub-optimisation of systems. There seems to be a lack of a unifying logistics approach that will allow consideration of the dynamic nature of systems to ensure system optimisation rather than sub-system optimisation.

This thesis proposes a different approach to prevent the sub-optimisation of logistics by viewing logistics from a system perspective rather than a functional perspective and at the same time consider the life-cycle of the system of interest. When viewing logistics from a system perspective, the question to ask is not to which function logistics belong, but within each phase of the system life-cycle, what the contribution is logistics needs to make to the overall system performance. In order to view logistics from a system and life-cycle perspective, there needs to exist an understanding of systems and system concepts. This understanding has to be supplemented by an understanding how systems are created. As logistics is concerned with man-made systems, two types of man-made systems require
understanding, namely organisational systems and product systems, also known as
durable goods.

By using the system principles of holism, synthetic thinking and teleology, it is
demonstrated that all systems can be described by generic sub-systems (the logistic sub-
system being one of them), the success of all systems can be measured using the generic
system measurements of ability, availability and affordability, and that all systems go
through a life-cycle. Based on the reality that organisations and durable products/services
all possess system characteristics as described above, and that non-durable
products/services form part of a higher level system, a generic model has been
constructed indicating the relationships and flow of the managerial and technical logistics
activities which need to take place at each stage of the system’s life-cycle to ensure that
the system ability, availability and affordability requirements are met.

To validate the model, high level system dynamic relationships were constructed and the
outcome of the application and non-application of the model argued using thought
experiments. This was done using an imaginary system comparing the effects if the
dynamic approach to logistics for the system is ignored to the effects if the dynamic
approach to logistics for the system is followed. The thought experiment was done for all
dimensions of logistics, namely operational support and maintenance support as well as
for the management of each dimension throughout the life-cycle.

It is thus concluded that following a dynamic approach to the logistics of a system greatly
enhances the system performance.
Acknowledgements

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Table of Contents

Declaration .................................................................................. i
Abstract .................................................................................. ii
Acknowledgements ...................................................................... iv
Table of Contents ......................................................................... v
  Chapter 1: Introduction .......................................................... vi
  Chapter 2: Logistics - The undefined overly defined concept .......... vii
  Chapter 3: Research design and methodology .............................. viii
  Chapter 4: The whole-life whole-system concept ......................... ix
  Chapter 5: Bringing systems into being ........................................ x
  Chapter 6: The organisation as a system ....................................... xi
  Chapter 7: Product systems ........................................................ xii
  Chapter 8: A generic integrated logistic support model for
    whole-life whole-systems ....................................................... xiii
    whole-life whole-systems ....................................................... xvi
  Chapter 9: Validating the integrated logistic support model for
    whole-life whole-systems ....................................................... xv
  Chapter 10: Conclusions and recommendations ........................... xvi
  Bibliography ............................................................................ xvii
List of Figures ............................................................................. xviii
List of Tables ............................................................................. xx
Abbreviations ............................................................................. xxi
# Introduction

## 1.1 Purpose and outline of the chapter

## 1.2 Background to logistics

## 1.3 The nature and the scope of the problem researched

## 1.4 The method and objective of the research

## 1.5 Thesis roadmap

## 1.6 The principal results of the research

## 1.7 The principal conclusions of the research
2 Logistics - The undefined overly defined concept

2.1 Purpose and outline of the chapter .............................................. 2-1

2.2 A historical perspective on logistics .......................................... 2-2

2.3 Logistics definitions ............................................................... 2-3

2.4 Existing logistic models ........................................................... 2-6
   2.4.1 Components of logistics management ................................. 2-6
   2.4.2 The scope of business logistics ......................................... 2-7
   2.4.3 Logistics in the system life-cycle .................................... 2-9

2.5 Confirmation of the problem statement ................................... 2-10

2.6 Chapter summary ................................................................. 2-11
3 Research design and methodology

3.1 Purpose and outline of the chapter .................................. 3-1

3.2 The nature of science and the scientific method .................. 3-2

3.3 The research design .................................................. 3-4
   3.3.1 Design description ............................................. 3-4
   3.3.2 Design classification .......................................... 3-5
   3.3.3 Conceptualisation and mode of reasoning ................... 3-5

3.4 The research methodology .......................................... 3-6
   3.4.1 Methodology defined ............................................ 3-6
   3.4.2 The structure of the research ................................ 3-7
   3.4.3 The model building process ................................... 3-10

3.5 Modelling basics .................................................... 3-10
   3.5.1 The definition and purpose of models ....................... 3-10
   3.5.2 The relationships between methodologies and models ....... 3-11
   3.5.3 Form and content of models ................................... 3-11
   3.5.4 Classification of models ....................................... 3-12
   3.5.5 The art of building models .................................... 3-14

3.6 Chapter summary .................................................... 3-15
4 The whole-life whole-system concept

4.1 Purpose and outline of the chapter ........................................ 4-1

4.2 Definition of a system ......................................................... 4-3

4.3 A modern view of system characteristics ............................... 4-5
  4.3.1 The machine age .......................................................... 4-6
  4.3.2 The systems age ........................................................... 4-6
  4.3.3 The effects of the development of systems theory ................. 4-8

4.4 A classification of systems ................................................... 4-9

4.5 The whole-system concept ................................................... 4-11
  4.5.1 The wider system (WS) ................................................. 4-12
  4.5.2 The realisation system (RS) .......................................... 4-15
  4.5.3 The system of interest (SOI) .......................................... 4-16
  4.5.4 An integrated view of the whole-system concept ................. 4-17

4.6 System structures ............................................................. 4-18

4.7 The whole-life or system life-cycle concept ........................... 4-21
  4.7.1 Covey’s view of the life-cycle ......................................... 4-21
  4.7.2 Hall’s view of the life-cycle ............................................ 4-22
  4.7.3 M’Pherson’s view of the life-cycle ................................... 4-23
  4.7.4 New technology and the life-cycle ................................... 4-25
  4.7.5 Moving away from the life-cycle? ................................... 4-27
  4.7.6 An integrated view of the life-cycle ................................ 4-28

4.8 Measurements of system success .......................................... 4-29
  4.8.1 Overall system measurements ......................................... 4-29
  4.8.2 System effectiveness (SE) .............................................. 4-30
  4.8.3 Life-cycle cost (LCC) .................................................... 4-32
  4.8.4 A new equation - benefit effectiveness ............................ 4-33
  4.8.5 The necessary conditions .............................................. 4-34

4.9 Chapter summary ............................................................. 4-34
5 Bringing systems into being

5.1 Purpose and outline of the chapter ........................................ 5-1

5.2 The quest for new systems .................................................. 5-2

5.3 The need for a formal process ............................................. 5-3

5.4 The multiple dimensions of systems engineering ....................... 5-3

5.5 Systems engineering defined ............................................. 5-5

5.6 M’Pherson’s perspective on systems engineering ....................... 5-7

5.7 The role and impact of systems engineering ............................ 5-10
   5.7.1 The ability perspective of systems engineering application .... 5-12
   5.7.2 The availability perspective of systems engineering application . 5-14
   5.7.3 The affordability (life-cycle cost) perspective of systems
        engineering application ............................................ 5-17

5.8 The realisation system’s approach to bringing systems into being .... 5-22

5.9 Chapter summary .......................................................... 5-26
6 The organisation as a system

6.1 Purpose and outline of the chapter ........................................... 6-1

6.2 The goal or teleology of an organisation ...................................... 6-2

6.3 Generic organisational measurements ........................................... 6-5
   6.3.1 Organisational ability .................................................... 6-5
   6.3.2 Productivity as a measurement of organisational ability .............. 6-7
   6.3.3 Availability ...................................................................... 6-7
   6.3.4 Affordability ................................................................. 6-8

6.4 The necessary conditions and its relationship with the goal ............... 6-8

6.5 Strategy formulation ................................................................. 6-12

6.6 The organisation as a system of dependent variables ....................... 6-18
   6.6.1 Porter’s value chain concept of the organisation ......................... 6-18
   6.6.2 The Purdue enterprise reference architecture ............................. 6-20
   6.6.3 Rottier’s enterprise life-cycle .............................................. 6-22

6.7 The larger system context - the supply chain ................................... 6-25

6.8 Chapter summary ...................................................................... 6-27
7 Product systems

7.1 Purpose and outline of the chapter ........................................ 7-1

7.2 Definition of a product .................................................... 7-2

7.3 Classification of products .................................................. 7-6
  7.3.1 Durability and tangibility classification of products ............. 7-6
  7.3.2 Industry sector classification of products ........................ 7-7
  7.3.3 Hierarchy classification of products .............................. 7-8

7.4 Support relationships between products and their realisation systems ... 7-10

7.5 Capacity required to support the product system .................... 7-13

7.6 Master planning as a tool to arrive at support capacity requirements .... 7-14
  7.6.1 Output and support demand management .......................... 7-15
  7.6.2 Output and support capacity planning ............................ 7-16
  7.6.3 Setting up the master schedule ..................................... 7-19

7.7 Chapter summary ......................................................... 7-22
8 A generic integrated logistic support model for whole-life whole-systems

8.1 Purpose and outline of the chapter .................................................. 8-1

8.2 The requirements for a generic model for integrated logistic support ....... 8-2

8.3 Broad outline of the model ............................................................... 8-2

8.4 The dimensions of the integrated logistic support model ...................... 8-4

8.4.1 Logistics engineering ................................................................. 8-5
  8.4.1.1 Terminology ..................................................................... 8-5
  8.4.1.2 Logistics engineering defined .............................................. 8-6
  8.4.1.3 Design influencing ............................................................ 8-7
  8.4.1.4 Identification and detailing of the support resources .......... 8-17
  8.4.1.5 Design of the support system and support resources .......... 8-21
  8.4.1.6 Designing the support management system ...................... 8-24
  8.4.1.7 Integrating the logistics engineering technical elements .... 8-28
  8.4.1.8 Managing the logistics engineering process ...................... 8-29

8.4.2 Operational logistics ................................................................. 8-30

8.4.2.1 Terminology ..................................................................... 8-30

8.4.2.2 Operational logistics defined .............................................. 8-30

8.4.2.3 Physical acquisition and commissioning of the system of interest ................................................................. 8-31

8.4.2.4 Operating and maintaining the system of interest .............. 8-32

8.4.2.5 Recycling, waste disposal and phasing out the system of interest ................................................................. 8-34

8.4.2.6 Managing the physical acquisition and commissioning ....... 8-35

8.4.2.7 Managing the ongoing operations .................................... 8-36

8.4.2.8 Managing the recycling, waste disposal and phasing out of the system ................................................................. 8-39

8.5 Integrating the logistics engineering and the operational logistics over the life-cycle ................................................................. 8-39

8.6 Verification of requirements ............................................................ 8-42

8.6.1 Viewing the whole-system and the interfaces with its environment ................................................................. 8-43

8.6.2 Viewing the system over its entire life-cycle ................................ 8-43

8.6.3 Allowing for an iteration of ideas to ensure optimum system design ................................................................. 8-43

8.6.4 Consideration of the operational environment when the conceptual design is started ................................................................. 8-43

8.6.5 Continuation of the systems engineering process until phase out. ................................................................. 8-44
9 Validating the integrated logistic support model for whole-life whole-systems

9.1 Purpose and outline of the chapter ............................... 9-1

9.2 Model validation and thought experiments .......................... 9-2

9.3 Introduction of Goldratt's thought experiment applied to an organisation as a system ....................................... 9-5

9.4 Using Goldratt's machine as the subject of the thought experiment to validate the generic model for integrated logistic support ........ 9-6

9.5 The structure of the thought experiment ........................... 9-7

9.6 The operations support perspective of achieving machine success .... 9-9

  9.6.1 Implication diagram tracing machine success when ignoring the approach to integrated logistic support .................. 9-9

  9.6.2 Implication diagram tracing system success when machine operability design and operational support system design is a conscious effort ...................... 9-13

9.7 The maintenance support perspective of achieving system success .... 9-18

  9.7.1 Implication diagram tracing system success when ignoring the approach to integrated logistic support .................. 9-18

  9.7.2 Implication diagram tracing the system success when system reliability, maintainability and maintenance system design is a conscious effort ...................... 9-22

9.8 The management perspective of achieving machine success ........ 9-28

9.9 Chapter summary ........................................... 9-29
10 Conclusions and recommendations

10.1 Purpose and outline of the chapter ................................. 10-1

10.2 Summary of research results ........................................ 10-2
   10.2.1 Dynamic and detail complexity of systems .................. 10-2
   10.2.2 Generic sub-systems ........................................ 10-2
   10.2.3 The dimensions of the system view ........................ 10-3
   10.2.4 The systems view and its relation to the support sub-system model ........................................ 10-3
   10.2.5 Implications of the model for integrated logistic support .... 10-4
   10.2.6 Contributions of the research ................................ 10-5

10.3 The principal conclusions of the research .......................... 10-6

10.4 Further research ..................................................... 10-6
Bibliography

List of references in author alphabetic order ........................................ 11-1
## List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1: Thesis roadmap</td>
<td></td>
<td>1-7</td>
</tr>
<tr>
<td>Figure 2.1: Components of logistics management</td>
<td></td>
<td>2-6</td>
</tr>
<tr>
<td>Figure 2.2: The relationship of the three primary logistic activities to serve a customer - the “Critical Loop”</td>
<td></td>
<td>2-7</td>
</tr>
<tr>
<td>Figure 2.3: The three primary logistic activities creating the supply chain</td>
<td></td>
<td>2-8</td>
</tr>
<tr>
<td>Figure 2.4: The scope of business logistics</td>
<td></td>
<td>2-9</td>
</tr>
<tr>
<td>Figure 2.5: The interrelationships of the life-cycle phases in system development</td>
<td></td>
<td>2-10</td>
</tr>
<tr>
<td>Figure 3.1: The structure of the research</td>
<td></td>
<td>3-8</td>
</tr>
<tr>
<td>Figure 4.1: The need within the wider system</td>
<td></td>
<td>4-12</td>
</tr>
<tr>
<td>Figure 4.2: The host system’s ways of realising the system of interest</td>
<td></td>
<td>4-14</td>
</tr>
<tr>
<td>Figure 4.3: The whole-system concept</td>
<td></td>
<td>4-17</td>
</tr>
<tr>
<td>Figure 4.4: Structure of the Proto-System</td>
<td></td>
<td>4-19</td>
</tr>
<tr>
<td>Figure 4.5: Satisfying a need through the two creations</td>
<td></td>
<td>4-21</td>
</tr>
<tr>
<td>Figure 4.6: The generic life-cycle phases</td>
<td></td>
<td>4-28</td>
</tr>
<tr>
<td>Figure 5.1: The multiple dimensions of systems engineering</td>
<td></td>
<td>5-5</td>
</tr>
<tr>
<td>Figure 5.2: An integrated perspective of systems engineering</td>
<td></td>
<td>5-9</td>
</tr>
<tr>
<td>Figure 5.3: Benefit-effectiveness breakdown</td>
<td></td>
<td>5-11</td>
</tr>
<tr>
<td>Figure 5.4: The life-cycle cost components</td>
<td></td>
<td>5-18</td>
</tr>
<tr>
<td>Figure 5.5: Total life-cycle cost</td>
<td></td>
<td>5-19</td>
</tr>
<tr>
<td>Figure 5.6: Designing for affordability - Shifting the life-cycle cost profile</td>
<td></td>
<td>5-20</td>
</tr>
<tr>
<td>Figure 5.7: Systems engineering influence on design and cost</td>
<td></td>
<td>5-21</td>
</tr>
<tr>
<td>Figure 5.8: Generic steps and feedback loops within acquisition phases</td>
<td></td>
<td>5-24</td>
</tr>
<tr>
<td>Figure 5.9: The systems engineering process and its interfaces with systems engineering management and required resources</td>
<td></td>
<td>5-25</td>
</tr>
<tr>
<td>Figure 6.1: The goal and necessary conditions for a profit oriented organisation</td>
<td></td>
<td>6-10</td>
</tr>
<tr>
<td>Figure 6.2: The goal and necessary conditions for a non-profit organisation</td>
<td></td>
<td>6-11</td>
</tr>
<tr>
<td>Figure 6.3: The systemic nature of strategy development for a profit oriented organisation</td>
<td></td>
<td>6-14</td>
</tr>
<tr>
<td>Figure 6.4: Porter’s value chain</td>
<td></td>
<td>6-19</td>
</tr>
<tr>
<td>Figure 6.5: Block diagram of the Purdue Enterprise Reference Architecture</td>
<td></td>
<td>6-21</td>
</tr>
<tr>
<td>Figure 6.6: The enterprise life-cycle</td>
<td></td>
<td>6-24</td>
</tr>
<tr>
<td>Figure 6.7: Porter’s value system</td>
<td></td>
<td>6-26</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>7.1</td>
<td>The tangibility scale</td>
<td>7-3</td>
</tr>
<tr>
<td>7.2</td>
<td>Three levels of product</td>
<td>7-4</td>
</tr>
<tr>
<td>7.3</td>
<td>Determinants of customer value</td>
<td>7-5</td>
</tr>
<tr>
<td>7.4</td>
<td>System support relationships</td>
<td>7-10</td>
</tr>
<tr>
<td>7.5</td>
<td>Input-Process-Output model</td>
<td>7-14</td>
</tr>
<tr>
<td>7.6</td>
<td>The interface between demand management and capacity planning</td>
<td>7-18</td>
</tr>
<tr>
<td>7.7</td>
<td>Support demand management interfaces</td>
<td>7-19</td>
</tr>
<tr>
<td>7.8</td>
<td>Master schedule development and execution</td>
<td>7-21</td>
</tr>
<tr>
<td>8.1</td>
<td>Outline of the proposed model for integrated logistic support for whole-life whole-systems</td>
<td>8-3</td>
</tr>
<tr>
<td>8.2</td>
<td>The relationship between integrated logistic support measurements and the system measurements</td>
<td>8-12</td>
</tr>
<tr>
<td>8.3</td>
<td>Logistics engineering - Establishing the concepts and design influencing</td>
<td>8-14</td>
</tr>
<tr>
<td>8.4</td>
<td>Logistics engineering - Identification and definition of the support resources</td>
<td>8-17</td>
</tr>
<tr>
<td>8.5</td>
<td>Detailed operational task and resource analysis</td>
<td>8-19</td>
</tr>
<tr>
<td>8.6</td>
<td>Detailed maintenance task and resource analysis</td>
<td>8-20</td>
</tr>
<tr>
<td>8.7</td>
<td>Logistics engineering - Design of the support system and support resources</td>
<td>8-22</td>
</tr>
<tr>
<td>8.8</td>
<td>Logistics engineering - Designing the support management system</td>
<td>8-25</td>
</tr>
<tr>
<td>8.9</td>
<td>The logistics engineering technical activities</td>
<td>8-28</td>
</tr>
<tr>
<td>8.10</td>
<td>Operational logistics - Operating and maintaining the system of interest</td>
<td>8-33</td>
</tr>
<tr>
<td>8.11</td>
<td>The generic integrated model for integrated logistic support for whole-life whole-systems</td>
<td>8-40</td>
</tr>
<tr>
<td>9.1</td>
<td>The model validation process</td>
<td>9-3</td>
</tr>
<tr>
<td>9.2</td>
<td>The relationship between the two dimensions of integrated logistic support and the system measurements</td>
<td>9-8</td>
</tr>
<tr>
<td>9.3</td>
<td>Implication diagram focussing on ability only, ignoring operational operability design and operational support system design</td>
<td>9-10</td>
</tr>
<tr>
<td>9.4</td>
<td>Implication diagram of the generic approach to integrated logistic support (Operational support perspective)</td>
<td>9-14</td>
</tr>
<tr>
<td>9.5</td>
<td>Implication diagram focussing on ability only, ignoring reliability, maintainability and maintenance system design</td>
<td>9-20</td>
</tr>
<tr>
<td>9.6</td>
<td>Implication diagram of the generic approach to integrated logistic support (Maintenance support perspective)</td>
<td>9-23</td>
</tr>
</tbody>
</table>
List of Tables

Table 1.1: Different viewpoints on logistics ........................................... 1-2
Table 4.1: The generic life-cycle modes and phases ............................... 4-24
Table 7.1: Comparison of customer expectations and system measurements 7-5
Table 7.2: Examples of systems in the systems hierarchy .......................... 7-9
Table 7.3: Example support requirements ............................................... 7-12
Table 7.4: Master schedule example ...................................................... 7-20
Table 8.1: The differences between support levels and level of repair ........ 8-10
Table 8.2: Different types of operational systems ................................. 8-38
A generic approach to integrated logistic support for whole-life whole-systems

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLM</td>
<td>Council of Logistics Management</td>
</tr>
<tr>
<td>CM</td>
<td>Corrective maintenance</td>
</tr>
<tr>
<td>DTF</td>
<td>Demand time fence</td>
</tr>
<tr>
<td>ERP</td>
<td>Enterprise resource planning</td>
</tr>
<tr>
<td>FMECA</td>
<td>Failure mode, effects and criticality analysis</td>
</tr>
<tr>
<td>FRACAS</td>
<td>Failure reporting, analysis and corrective action system</td>
</tr>
<tr>
<td>HS</td>
<td>Host system</td>
</tr>
<tr>
<td>ILS</td>
<td>Integrated logistic support</td>
</tr>
<tr>
<td>IPC</td>
<td>Illustrated parts catalogue</td>
</tr>
<tr>
<td>LORA</td>
<td>Level of repair analysis</td>
</tr>
<tr>
<td>LSA</td>
<td>Logistic support analysis</td>
</tr>
<tr>
<td>MMIS</td>
<td>Maintenance management information system</td>
</tr>
<tr>
<td>PHS&amp;T</td>
<td>Packaging, handling storage and transportation</td>
</tr>
<tr>
<td>PM</td>
<td>Preventive maintenance</td>
</tr>
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<td>PPPM</td>
<td>Preparation, preservation, packaging and marking</td>
</tr>
<tr>
<td>PS</td>
<td>Planning system</td>
</tr>
<tr>
<td>RCM</td>
<td>Reliability centred maintenance</td>
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<tr>
<td>RS</td>
<td>Realisation system</td>
</tr>
<tr>
<td>SA</td>
<td>Supportability analysis</td>
</tr>
<tr>
<td>SOI</td>
<td>System of interest</td>
</tr>
<tr>
<td>SOLE</td>
<td>Society of Logistic Engineers</td>
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<tr>
<td>WIP</td>
<td>Work in process</td>
</tr>
<tr>
<td>WS</td>
<td>Wider system</td>
</tr>
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“It is easier to perceive error than to find truth, for the former lies on the surface and is easily seen, while the latter lies in the depth, where few are willing to search for it”

Johann Wolfgang von Goethe