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

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A thesis submitted in partial fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

in the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT
AND INFORMATION TECHNOLOGY

UNIVERSITY OF PRETORIA

December 2002

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.

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ABSTRACT

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

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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

I would like to express my sincere thanks to:

- The almighty God, my Saviour, who is the Creator and Maintainer of the system we call universe, through whom this study was possible.

- My wife Mariana, who was always there when I needed her, for the encouragement and support through the long years of slow progress.

- My daughter Thandi, whose name means ‘The loved one’, for her bright smile and hugs for no reason.

- My son Pieter-Jan, who came into our lives at the conclusion of this study, who so clearly demonstrates the system principles of dependency and variability.

- My parents Francois and Frances Pretorius, who have taught me the virtues of honesty and hard work, for their unconditional love and continued support with every endeavour undertaken.

- Eli Goldratt, who challenges the old ways, for stimulating my ability to think.

- Johan Rottier, friend and colleague, systems thinker, for the many times he was willing to listen to new ideas.

- Arnold Botha, friend and colleague, who stimulated my interest in this thing called logistics very early in my career.

- Everybody, including many students, who ever crossed my path, whether we agreed or disagreed, for helping in the progress I have made in this unfinished journey of understanding logistics.

- Professor Paul Kruger, who shares my passion for thought experiments, who has taught me the virtue of writing with clarity (I still don’t get it write the first time), and for his direction and guidance. *Carpe Diem!*

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Abbreviations

CLM	Council of Logistics Management
CM	Corrective maintenance
DTF	Demand time fence
ERP	Enterprise resource planning
FMECA	Failure mode, effects and criticality analysis
FRACAS	Failure reporting, analysis and corrective action system
HS	Host system
ILS	Integrated logistic support
IPC	Illustrated parts catalogue
LORA	Level of repair analysis
LSA	Logistic support analysis
MMIS	Maintenance management information system
PHS&T	Packaging, handling storage and transportation
PM	Preventive maintenance
PPPM	Preparation, preservation, packaging and marking
PS	Planning system
RCM	Reliability centred maintenance
RS	Realisation system
SA	Supportability analysis
SOI	System of interest
SOLE	Society of Logistic Engineers
WIP	Work in process
WS	Wider system

"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