#### Certification Project for the Graduate Professional Program CSAP15

Modeling and Analyzing the Integration of Logistics Operations Management to the Inter-modality Concept of Shipping Transportation: a systemic approach

Applied Systemic Methodologies on a Shipping Company

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### **Presentation Structure**

- Introduction
- The Scope of the Forwarding Operations Department
- Current Situation (CS) of the problem P
- Design of CS with DCSYM and Definition of P
- Suggested Improvements (SI)
- Implementation of DCSYM to SI
- Viable System Model (VSM) Theory
- Application of VSM to VSMod

# **Presentation Structure (continue)**

- System Dynamics with the use of Vensim Software
  - Model Explanation
  - Project Control, Side Effects etc.
- Importing Vensim model into Anylogic Software
- Hybrid Modeling (System Dynamics & Agent-based Modeling)
  - Chart Screenshots
- Results, Innovations and Future Extensions of the Certification Study

# Introduction

<u>The main purpose</u> of this study is to:

- Examine all the structures of the studied system and also its included subsystems
- The localization of all the current communications among the main system and the rest of engaged (sub-) systems, individuals and also the external environment.

#### The main targets of this study is:

- The detection of potential structural and communicational problems among the systems
- The potential improvement of the current structures and communications

<u>Appropriate Interventions</u> will result to the short-term increase of performance and productivity through the active participation of the whole company in the Integrated Intermodal Container Transportation

# **Organizational Chart**



### The Scope of the Forwarding Operations Department

- Transportation Management of all the imported and exported containers with direction from/to the ports
- The coordination of the required actions for the in-time hinterland transportation of containers (imported-exported) to their final destination (warehouses-ports)
- Active participation in contemporary transportation applications (Intermodality - Multimodality Concept) through the cooperation with the Liner Operations Department
- Transportation Delay Management and direct solutions to relevant emerging problems

# Initial System's Structure with DCSYM Case Tool



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# **Current Situation (CS) of the problem P**

- Diffused communications among the involved subsystems, necessary for vital operations of main systems. This leads to significant delays and problems in transportation project management
- Lack of fundamental information updating to the departmental managers because of the necessity to direct and multiple communications of operational units managers with other departments and individuals

Increased Coordination Difficulty regarding the actions of Logistics Operations Management because of the necessary internal management of huge information and data volume

### **Current Situation (CS) of the problem**

Lack of detailed sales representation to all the involved parts for the effective decision making with relation to the short/mid-term organization development

# **Design of Current Situation with DCSYM**



# **Systems Table**

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ĥ.1E	Environment.Ministries		1.1.1.3s	c	1.1.2.1s	Communication
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1.1.1s	Logistics Operations.Forwarding Operations		1 1 11	11	1 4 19	Communication
1.1.1i	Logistics Operations.Logistics Manager		1 1 2 14		1 4 10	Communication
1.1.1.1s	Forwarding Operations.Overland		1 1 2 14	u	1.4.15	Communication
1.1.1.1i	Forwarding Operations.Manager		1.1.2.11	u	1.4.28	Communication
1.1.1.2s	Forwarding Operations.Exports		1.1.2.15		1.1.1.45	Communication
1.1.1.3s	Forwarding Operations.Imports		1.1.2.2s	c	1.1.1.4s	Communication
1.1.1.4s	Forwarding Operations.Demurrage		1.1.2.3s		1.1.1.2s	Communication
1.1.2s	Logistics Operations.Liner Operations		1.1.2.3s	c	1.1.1.3s	Communication
1.1.2.1s	Liner Operations.Import		1.1.2.3s	u	1.1.2.1s	Communication
1.1.2.1i	Liner Operations.Manager		1.1.2.3s	u	1.1.2.2s	Communication
1.1.2.2s	Liner Operations.Export		1.1.2.4s	a	1.1.2.1s	Communication
1.1.2.3s	Liner Operations.Container Warehouse		1.1.2.48	a	1.1.2.28	Communication
1.1.2.4s	Liner Operations.EQC&Idle		1 1 2 4	11	1 1 2 30	Communication
1.2E	Environment.Port Authorities	and a	1 12	u	1.1.2.55	Communication
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1.2.15	Overseas Agency.Business Development	1	1.2.11	u	1.4.1s	Communication
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1.2.1.11	Susiness Development.Manager		1.2.2s	c	1.1.1.2s	Communication
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1.3.2s	Shipping Business.Sales		1.5.15	g	1.3.28	Communication
1.3.2.1i	Sales.Manager		1.3.15	u	1.3.35	Communication
1.3.3s	Shipping Business.Customer Services	and the second	1.3.2s	g	1.2.1s	Communication
1.3.3.li	Customer Services.Manager	the second s	1.3.2s	g	1.3.3s	Communication
1.4E	Environment.Markets	and the second se	1.3.3s	g	1.4.3s	Communication
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1.4.1s	Other Departments/Services.Financial Dept	A DESCRIPTION OF TAXABLE PARTY.	1.4.1s	u	1.4.2s	Communication
1.4.2s	Other Departments/Services.Ship Operations		1.4E		1.35	Communication
1.4.3s	Other Departments/Services.Agency Operations		1.4E	11	1.25	Communication
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# **Communications Table**



# **Communications Table**

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### **Suggested Improvements**

Incorporation/Creation of a totally new unit ( or sub-unit ) – namely, Supply Chain Analytics – with obvious purpose to sufficiently collect and manage all the required information volume that organization accepts.

- Abolishment of the most internal communications of the Department of Logistics Operations and their accumulation to the new unit
- Creation of additional communication channels between the new unit and the external environment for the collection of further necessary data with regard to containers transportation

### **Suggested Improvements with DCSYM Case Tool**



# **Communications Table**



# **Communications Table**

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### Comparing

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# **Viable System Model - Theory**

An autonomous (alternatively viable) system needs to contain 5 key – systems in order to effectively operate on his environment:

- Implementation: The primary activities (the core) which produce products and services
- Coordination : Systems which coordinate the interface of added value functions ( communication channels and instructions from the upper management levels ) with the operational units
- Control: Bi-directional communication among subsystems and the meta-system for ensuring their smooth operation

The three above systems timely refer to the PRESENT

# Viable System Model - Theory

An autonomous (alternatively viable) system needs to contain 5 key – systems in order to effectively operate on his environment:

- Intelligence: The bi-directional connection among primary activities and the external environment. This system timely refers to the FUTURE
- Policy: The top decision making system policy configuration.
   This system timely refers to EVERYTHING

### Viable System Model (VSM) - Theory



### Viable System Model - Θεωρία

A viable system needs to have the ability to be continuously adapted to every change on its external environment in order to learn and evolve by the experience it acquires. It generally happens with the appropriate use of its acquired information as below:





#### Policy – System 5

**Organization's Mission and Vision**:

The powerful presence of organization in a developing geographically market with clear purpose to innovate on the door-to-door container transportation services.

Direct, Integrated and Reliable All-the-Product Transportation Services.

#### <u>Intelligence – System 4</u>

- The Forwarding Operations Manager is responsible for the personnel development, the management of transportation projects and also the planning and coordination of all the required procedures and actions
- The ever increasing technological developments in transportation systems, any national and international legal reformations and amendments, critical changes on global and regional economy etc., are all sensory for information collection in order to be reconfigured possible decisions regarding the future.

#### Intelligence – System 4



#### <u>Control – System 3</u>

- The Forwarding Operations Manager is responsible for the transmission of instructions, the solution of emerging conflicts, the urge of personnel and others.
- On this system, the goals of performance and productivity are imposed.

#### Control – System 3 PROGRESS REPORT INFORMATION CLASSIFICAT WAYS OF REPORT - MEETINGS AND REPORTS Amplifyier input output HIGHER VARIETY BLOCK : LOWER VARIETY BLOCK : STABILITY CRITERIA : OPERATIONAL UNIT MANAGER DEPARTMENTAL MANAGER COMMON VISION COMMUNICATION READINESS output input Attenuator ASSESSMENT AND TARGETS MEETINGS AND REPORTS PRIORITIES

#### Control – System 3 (Relationship with System 3\*)



#### Coordination – System 3\*



#### <u>Coordination – System 2</u>

On this system, the detailed project scheduling, as it has to be followed by the operational units, takes place.

On System 2, the upper manager and the managers of the operational units frequently meet together in order to being implemented the required anti-oscillation of the system.



#### **Implementation – System 1**

Through the Algedonic Channels it is being implemented the direct bottom-up promotion of potential problems, difficulties and complications on current workflows for their timely effective solution.

### **Model Explanation**



# **Project Control**

- Possible Decisions :
- Leasing of Additional Trucks
- Increase on Combined Routings (Two Containers per Truck)
- Redistribution of Trucks Used between the Main Port and Dry Port\*

etc.

Dry Port: a space near to the main port used for the decongestion of main port

### **Project Control**



# Side Effects

The potential leasing of additional trucks will cause:

- Increase on Cost Long-Term Decrease On Demand
- Truck Congestion to Ports Delays
- Increased Difficulties on Routing Scheduling and Coordination
- Impacts of the above effects on total Productivity

Possible Combined Routings/Orders will result to increased order cycles

### **Side Effects**



### **Data-driven Fleet Optimization**



### **Systemic Relationship Dry Port – Main Port**



# **Agent Creation in Anylogic**

We use an agent-based approach in order to take the engaged ships into consideration in our simulation model. The corresponding state chart developed in Anylogic is :



![](_page_39_Picture_3.jpeg)

# **Importing Vensim model into Anylogic**

![](_page_40_Figure_1.jpeg)

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![](_page_42_Figure_1.jpeg)

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![](_page_45_Figure_1.jpeg)

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### Importing Vensim model into Anylogic -Adding Statistics to AB part-

![](_page_47_Figure_1.jpeg)

### Importing Vensim model into Anylogic -Adding Time Stack Chart-

![](_page_48_Figure_1.jpeg)

![](_page_49_Figure_1.jpeg)

![](_page_50_Figure_1.jpeg)

![](_page_51_Figure_1.jpeg)

The developed colored charts in Anylogic give us in depth information about the daily number of ships on their respective and potentially interesting position.

- Ships On The Port
- Ships on The Offshore Warehouse
- Ships Moving to Port
- Ships Moving to Warehouse

![](_page_52_Figure_6.jpeg)

A Shipping Transportation : Simulation - AnyLogic Professional [EVALUATION USE ONLY]

![](_page_53_Figure_2.jpeg)

![](_page_53_Figure_3.jpeg)

![](_page_53_Picture_4.jpeg)

# Results

- With the use and implementation of Systemic Methodology DCSYM we depicted the current situation (CS) of the problem P in the system-onfocus of our study. The specific methodology enabled us to effectively intervene on the system solving current structural and communicational insufficiencies.
- Viable System Model theory made us able to examine thoroughly the viability of our system while VSMod software tool illustrated the adaptable structure of Forwarding Operations Department.

# Results

- Vensim PLE was used in order to apply system dynamics in the core procedure of our studied system regarding the forwarding operations of imported and exported containers.
- Finally, Anylogic was complementary used for being taken the ships into consideration as agents contributing that way to the detailed hybrid simulation modeling of our system.
- The final simulation model can give us extended information about the dynamic states of all the engaged parties to the Logistics Operations of the organization.

### **Innovations - Future Extensions**

- The main innovation of this study lies on the effective management of logistics operations with respect to intermodal transportation concept and the data-driven decision making by a systemic point of view.
- The integration of global logistics operations to shipping transportation as an internal part of modern shipping companies is a high promising direction for future success.
- Further extensions of this certification study could be applications of system dynamics techniques and hybrid modeling approaches to other nodes of intermodal networks.
- Moreover, additional stakeholders could be taken into account on the model creation.

# Thank you,

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