PhD Research Proposal in Business, Economics and Statistics
Logistics and Operations Management
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1. Introduction

A successful logistics system could help to improve traffic environment and transportation development. Since transportation contributes the highest cost among the related elements in logistics systems, the improvement of transport efficiency could change the overall performance of a logistics. Transportation plays an important role in logistics system and its activities appear in various sections of logistics processes.

The application of logistic model computation and case studies include nonlinearity occurrences in Ecology, Biology, Environmental Sciences, Aerospace and Oil & Gas. Due to the presence of global and local fluctuations and a lack of precision of measurements, one has to deal with effects of randomness on such models using stochastic independent modeling and further validation experiments.

Logistics and Operational management, here with is discussed in perspective to Oil & Gas applications. The similar logistic operations and models can be beneficial implemented in other industrial sectors.

1.1. Logistics Management

*Logistics is ‘part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers requirements’* [1,7]

The objective of logistics process management is to get the right quantity and quality of materials to the right place with respect to right time, client, and price.

*A Supply Chain is a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system. Supply Chain Management is the management of flow of materials, information, and funds across the entire supply chain [1].*

The general concept of an integrated supply chain is often illustrated by a line diagram [A-Fig.1] that links participating firms into a coordinated competitive unit. The figure illustrates a generalized model adapted from the supply chain management program.

*Material management is central to manufacturing and trading industry. Material management forms the internal part of the complete supply chain. Material is sourced, procured, stored, processes or produced, distributed and sold [A-Fig.2].*

The entire process of logistics deals with the moving of materials (goods movement) into, through, and out of a firm, can be categorized into three areas. (1) Inbound logistics - Procurement (2) Internal logistics – Store (3) Outbound logistics – Sales and distribution
2. Transportation & Distribution

Transportation accounts for two-thirds of total logistic costs. Transportation increases the time and place utility of products by delivering them at right time and place. Various options for moving products from one place to another are called transportation modes. Road, rail, air, water and pipelines are considered the five basic modes of transportation [A-Fig.3]

The Transportation and Distribution (TD) application area covers the logistics activities related to:

- Delivery of product from a delivering plant to a customer
- Transfer of product between two company-owned locations
- Receipt of purchased product from a vendor

These activities are carried out across the processes of scheduling, load confirmation, and delivery confirmation [A-Fig.4]

Therefore, transportation is the base of efficiency and economy in business logistics and expands other functions of logistics system

3. Logistic distribution modeling

Logistic models encounter uncertainty in which variables or parameters have the probability of occurrence, a highly promising technique of solving stochastic optimization problems is the robust programming proposed by Mulvey et al [3]. Logistic planning and management largely focus on minimizing the cost associated with producing and distributing products under a variety of constraints.

Considering one product flow of material, the total minimizing cumulative cost is determined. The below example ‘cost-transport’ deterministic logistic model applies for finding cost optimization [8]. This equation will be extended to logistic multi dimensional cross functional nodal network analysis of transportation and distribution.

\[
\sum_{i} \sum_{k} c_{ik} x_{ik} + \sum_{k} c_{k} x_{k} + \sum_{k} \sum_{j} c_{kj} x_{kj}
\]

Notations:

- \(x_{ik}\) denotes the amount of raw material shipped from location \(i\) to plant \(k\),
- \(x_{k}\) represents the amount of product \(x\) produced at plant \(k\),
- \(x_{kj}\) is the amount of product \(x\) shipped from plant \(k\) to market \(j\),
- \(c_{ik}\) denotes the unit cost for raw material shipped from location \(i\) to plant \(k\),
- \(c_{k}\) represents the unit cost for producing product in plant \(k\),
- \(c_{kj}\) is the unit cost for transporting product from plant \(k\) to market \(j\)

Eq.(1.1)
$ckj$ is the unit cost for shipped the product from plant $k$ to market $j$.

The objective function in Eq.(1.1) expresses the cumulative cost which consists of transportation, production, and inventory.

4. Research objectives and Conclusion

The research shall minimum focus on the following:

- **Complex supply chains comprise several levels of entities (suppliers, producers, warehouse, clients) and various modes of transport between entities. The goal of the research is to determine a state of the art in this area and investigate specific applications like Oil & Gas in context of business economics.**

- **Computational Logistic distribution modeling**
  Logistic examples and logistic problems will be discussed. Computational distribution of logistic models will be analyzed to bring robust efficient models, Logistic independent testing is made using computer programming, results are post processed using scientific excel and stochastic modeling tool.

- **Complex Transport networks design and optimization**
  Complex freight transport network involves several modes of transport and transshipment points involving goods or container handling activities (example: for rail/road or surface / maritime transport). The design and optimization of transport networks involve problems such as the location of transshipment points in the network, the choice of transport modes and the optimization of flows through the network. The goal of the research is to determine the problems and methods in this area and focus on one specific application such as maritime, rail/road networks or inland navigation networks.

- **Inventory - routing problems**
  In areas such as petroleum or liquid gas distribution, producers or vendors need to organize multi routing problems on several days in order to deliver products to consumers and manage their inventory of products to avoid stock outs. The goal of the research is to make a state of the art of problems and models in Oil & Gas sector.
References

Appendix

Figure 1. Integrated Supply chain network. Source [5]
Figure 2. The implementation path which is commonly followed by European companies.

<table>
<thead>
<tr>
<th>General characteristics</th>
<th>Road</th>
<th>Rail</th>
<th>Air</th>
<th>Water</th>
<th>Pipeline</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product options</td>
<td>Very broad</td>
<td>Broad</td>
<td>Narrow</td>
<td>Broad</td>
<td>Very narrow</td>
<td>Very narrow</td>
</tr>
<tr>
<td>Predominant traffic</td>
<td>All types</td>
<td>Low-moderate</td>
<td>High value, low-moderate density</td>
<td>Low value, high density</td>
<td>Low value, high density</td>
<td>All types of data</td>
</tr>
<tr>
<td>Market coverage</td>
<td>Point to point</td>
<td>Terminal to terminal</td>
<td>Terminal to terminal</td>
<td>Terminal to terminal</td>
<td>Terminal to terminal</td>
<td>Point to point (computer to computer)</td>
</tr>
<tr>
<td>Average length of load</td>
<td>Short to long</td>
<td>Medium to long</td>
<td>Medium to long</td>
<td>Medium to long</td>
<td>Medium to long</td>
<td>Short to long</td>
</tr>
<tr>
<td>Capacity</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>Very high</td>
<td>Very high</td>
<td>Moderate</td>
</tr>
<tr>
<td>Service characteristics</td>
<td>Cost</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td></td>
<td>Speed (time in transit)</td>
<td>Moderate</td>
<td>Slow</td>
<td>Fast</td>
<td>Very slow</td>
<td>Very fast</td>
</tr>
<tr>
<td>Availability</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>Very high</td>
</tr>
<tr>
<td>Delivery time consistency</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Loss and damage</td>
<td>Low</td>
<td>Moderate-high</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>Flexibility</td>
<td>High</td>
<td>Moderate</td>
<td>Low-moderate</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Intermodal capability</td>
<td>Very high</td>
<td>Very high</td>
<td>Moderate</td>
<td>Very high</td>
<td>Very low</td>
<td>Very low</td>
</tr>
</tbody>
</table>

**Figure 3. Characteristics of Transportation Modes [1]**

![Figure 3. Characteristics of Transportation Modes](image)

**Figure 4. Transportation and Distribution process in Oil & Gas Downstream [7]**

![Figure 4. Transportation and Distribution process in Oil & Gas Downstream](image)