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Modeling (identification and prioritization) of logistics processes in the Agrifood Supply Chain

I. Manikas¹, A. Kelemis², D. Folinas³

¹ Business School University of Greenwich, UK, imanikas@yahoo.com

² Department of Logistics, ATEI Thessaloniki, Greece, akelemis@hotmail.com

³ Department of Logistics, ATEI Thessaloniki, Greece, dfolinas@gmail.com

Introduction

- Business Process: *“a set of logically related tasks performed to achieve a defined business outcome”*
- Logistics Processes: *“business processes of the logistics system”*
- Logistics Processes in the Agrifood Supply Chain: *Why?*
 - Because of its high significance for the Greek economy
 - Because the great majority of the agrifood companies don't have the required know-how, the high-skilled workers and the advanced information technology infrastructure in order to design, execute, control and monitor their logistics processes
 - A large proportion of them doesn't maintain and use any enterprise information system (ERP, CRM, SCM, etc.) at all, and even if they do, it does not support a holistic approach of the monitoring and management of business processes
 - Furthermore, many companies do not maintain any quality standard (such as ISO, HACCP) and even if they are qualified they are not able to use it as a tool / mechanism for the effective re-design of logistics processes
- Companies can focus on the key logistics processes in order to optimize their critical aspects such as time and cost issues, resources planning and scheduling, as well as, queues and delays

Methodology

Methodology for the identification and prioritization of logistics processes in the Agrifood Supply Chain

Step 1: Classification of the generic areas of logistics processes

1. Which are the logistics processes?
2. Can be classified?

Step 2: Weighting, prioritization and selection of logistics processes

1. Are all the logistics processes of the same significance?
2. Based on what criteria the logistics processes can be prioritized?

Methodology

Step 1: Classification of the generic areas of business processes

- Literature review
- 8 groups
 1. Production support
 2. Transportation and Distribution
 3. Warehousing and Inventory Management
 4. Order processing
 5. Procurement
 6. Materials handling
 7. Quality management (including traceability)
 8. Environment

Group	Logistics processes
Production support	Planning of primary production [PR1] Procurement for production [PR2] Harvesting [PR3] Production scheduling and materials planning [PR4] Production of finished and semi-final products [PR5] Production planning [PR6] Selection of production machines and lines [PR7] Layout planning [PR8]
Transportation and Distribution	Planning of distribution tasks [DIST1] Planning of distribution network [DIST2] Planning of transportation management [DIST3] Control and monitoring of transportation management [DIST4] Selection of transportation means [DIST5] Selection of transportation materials [DIST6] Monitoring and tracing of product [DIST7] Routing and scheduling of transportation means [DIST8]
Warehousing and Inventory Management	Location of warehouse or distribution center [WARE1] Layout of warehouse or distribution center [WARE2] Selection of warehousing facilities [WARE3] Selection of warehousing materials [WARE4] Coding of products and storage positions [WARE5] Materials management [WARE6] Inventory management [WARE7] Inventory control (monitoring) [WARE8] Demand forecasting [WARE9] Physical inventory [WARE10]
Order processing	Order handling [ORDE1] Management of infrastructure for order handling [ORDE2] Planning of picking [ORDE3] Execution of picking [ORDE4] Order's packing [ORDE5] Planning of shipment facilities [ORDE6] Shipments management [ORDE7] Execution of shipments [ORDE8] Returns management [ORDE9]

Group	Logistics processes
Procurement	Planning of procurement [PROC1] Execution of procurement [PROC2] Monitoring of execution of procurement [PROC3] Proposals management [PROC4] Selection of suppliers and assignments [PROC5] Evaluation of suppliers [PROC6]
Materials handling	Planning of inbound materials handling [MATE1] Forecasting of inbound materials handling [MATE2] Execution of inbound materials handling [MATE3] Monitoring of inbound materials handling [MATE4]
Quality management (including traceability)	Quality control [QUAL1] Total Quality Management [QUAL2] Quality of services [QUAL3] Traceability and monitoring of production and material handling [QUAL4]
Environment	Unused final and semi-final products handling [ENV1] Byproducts handling [ENV2] Packaging materials handling [ENV3] Gas emission / pollutants production [ENV4] Byproducts transportation management [ENV5] Energy consumption management [ENV6]

Methodology

Step 2: Weighting, prioritization and selection of logistics processes

- Logistics processes of agribusiness supply chain that came out from the previous step are prioritized and classified based on the following criteria:
 1. Logistics processes, which are **essential for the customer** and also for the existence of the company
 2. Logistics processes, which **cost so much**. They are consuming **significant resources** (informational, financial, technological, human resources, etc.)
 3. Logistics processes, which **contribute considerably** to the added value of services and products
 4. Logistics processes, which regularly **generate problems**, errors and delays
- Logistics processes evaluation using a simple mathematical equation (Logistics Processes Rank, LPR)

The methodology for estimating the LPR for the prioritization of the logistics processes includes the following four (4) tasks:

- Task 1: Ranking the process from 1 to 7 for each of the above criteria
 - Task 2: Summing up the above ranks in order to estimate the LPR for each process
 - Task 3: Estimating the average of all the LPR's and
 - Task 4: Ordering all the averages in descending order creating the prioritization list
- In order to apply the above tasks in real-life cases, a research has been carried out

Process Criterion	A	B	C	D
Process X	5	7	3	5

- LPR equals to: $X = 5 + 7 + 3 + 5 = 20$
- If the same logistics process is evaluated by other two (2) managers with 18 and 25 the average is 21
- Following the same procedure the LPR's of all the logistics processes are estimated and ordered on descending order
- Then the critical (key) processes can be identified using the Pareto's principle (80-20 rule). Thus, the key logistics processes can be considered as the 20% of the total number

Survey

- In order to implement and check the validity of our proposed methodology a survey consisting of a cover letter and a questionnaire were mailed from July to December 2010
- Managers (CEO's, Operations and Logistics Managers) of the 40 largest agrifood companies in Greece
- 19 completed questionnaires were returned by those surveyed (response rate: 48%)
- A corresponding number of interviews were arranged with the above managers
- Managers asked to insert their ranks about the criticality of the logistics processes
- Managers could choose from 7: Very high significance to 1: Very low significance in order to evaluate the logistics processes that were categorized to 8 groups

Survey: findings

PR1	PR2	PR3	PR4	PR5	PR6	PR7	PR8		
6,42	5,50	5,56	6,03	6,14	5,58	5,22	5,03		
DIST1	DIST2	DIST3	DIST4	DIST5	DIST6	DIST7	DIST8	DIST9	
5,31	4,94	4,58	4,92	4,28	4,58	5,44	5,08	4,92	
WARE1	WARE2	WARE3	WARE4	WARE5	WARE6	WARE7	WARE8	WARE9	WARE10
4,92	5,03	4,97	4,61	4,17	4,97	5,08	5,25	4,94	5,28
ORDE1	ORDE2	ORDE3	ORDE4	ORDE5	ORDE6	ORDE7	ORDE8	ORDE9	
5,67	5,14	5,25	5,06	5,72	4,58	4,72	4,94	4,64	
PROC1	PROC2	PROC3	PROC4	PROC5	PROC6				
5,67	5,31	5,22	5,25	5,14	5,19				
MATE1	MATE2	MATE3	MATE4						
4,53	5,17	4,89	4,61						
QUAL1	QUAL2	QUAL3	QUAL4						
6,06	5,92	5,89	5,69						
ENV1	ENV2	ENV3	ENV4	ENV5	ENV6				
4,19	4,25	4,50	4,47	3,83	4,36				

PR: Production support
 DIST: Transportation and Distribution
 WARE: Warehousing and Inventory Management
 ORDE: Order processing
 PROC: Procurement
 MATE: Materials handling
 QUAL: Quality management (including traceability)
 ENV: Environment

Survey: findings

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- 1) Planning of primary production
- 2) Production of finished and semi-final products
- 3) Quality control
- 4) Production scheduling and materials planning
- 5) Total Quality Management
- 6) Quality of services
- 7) Order's packing
- 8) Traceability and monitoring of production and material handling
- 9) Planning of procurement
- 10) Order handling
- 11) Production planning
- 12) Harvesting
- 13) Procurement for production

Survey: findings

- In order to have the above results we consider that all of the 4 criteria (A, B, C, and D) are of the same significance (25%)
- Different companies have different objectives and business priorities regarding their logistics processes
- Sensitivity analysis

Cases \ Criteria	A	B	C	D
1	50%	16,67%	16,67%	16,67%
2	16,67%	50%	16,67%	16,67%
3	16,67%	16,67%	50%	16,67%
4	16,67%	16,67%	16,67%	50%

- Most critical processes for each group of logistics processes

Survey: discussion

- Most of the key logistics processes belong to the “Production support”, “Quality management” and “Order processing” groups. *This result was expected due to the nature of the industry and the specific needs of the products*
- A number of logistics processes are not appeared on the list. Specifically, processes from the “Transportation and Distribution”, “Materials Handling”, and “Warehousing and Inventory Management” groups
- Managers are focusing on the production and quality issues because they consider them as the processes that support their companies’ competitiveness
- Most managers consider environmental issues as less significant. *This reveals that in most agribusiness companies the focus is on the policies and the strategic level and less on operational level*

Survey: limitations

- Subjectivity of the answers, due to the fact that the respondents were come from the production and quality functional areas of the companies
- Size of the sample
- Small differences of the scores (marks)
- Difficulty of the accurate definitions of logistics processes can lead to incorrect results

Conclusions

- This paper focused on a specific class of logistics processes of agribusiness supply chain, those that can be described to be of high task complexity and high knowledge intensity
- For these processes a systematic approach for the identification and prioritization of logistics processes was proposed, applied and validated by a survey
- A number of key logistics processes was the outcome of the proposed methodology
- It is critical for the agribusiness companies to develop a number of performance measurement indexes and metrics for these processes
- Moreover, they must to standardize these processes and apply continuous improvements approaches

Conclusions

- Future studies of this subject should consider expanding the proposed methodology into specific sectors and/or products
 - The B criterion can be separated to two criteria: one for the cost and one for the assignment of resources
 - More complicated techniques for the prioritization of the criteria's' significance can be proposed instead of the sensitivity analysis, such as the Analytical Hierarchical Process (AHP)
- The ultimate aim is to help agrifood companies to optimize their logistics processes