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Decision Support Systems for Strategic Information Systems Planning: An Approach for Logistics Strategic Management

Abstract

As business environment is getting more and more turbulent, effective strategic management and decision-making is necessary, thus the implementation of Decision Support Systems (DSS) is considered crucial to sustain competitive advantage. Information Systems (IS) are used to collect information and to support the decision making to select the right strategy. In this view, Strategic Information Systems Planning (SISP) and its alignment with business planning improves business performance. DSS have been widely applied in Logistics but surveys which indicate their strategic approach are limited. Although Logistics is the function which consists of the management of material and information flows and it is significant in satisfying customers' needs, researchers have just recently started paying attention in its strategic role. This paper proposes a strategic DSS framework which combines both the strategic management process and SISP to provide an approach so as to achieve effective decision making in Logistics.

Keywords: Decision Support Systems; Strategic Management; Business Strategy; Strategic Information Systems Planning; Logistics.

1. Introduction

As the current business environment is uncertain, several approaches, such as operational research techniques, statistical methods and strategic management, try to minimize complexity in decision making. This effort has been supported by the development of Information Technology (IT). By the development of IT, businesses can minimize uncertainty to a specific level, since they have been able to gather information and make decisions more promptly and accurately.

Obviously, strategic management is the most significant controllable factor defining the long-term success or failure of the business and it is accepted as such by leading businesses (Yoo and Digman, 1987). Both managers and academics have focused their interest on strategic planning in order to compete in a rapidly changing environment (Moormann and Lochte-Holtgreven, 1993).

Logistics is becoming a competitive resource and the need to develop formal plans for this function has been recognized. Researchers have just recently started paying attention in the strategic role of logistics. Logistics have strategic impacts on customer’s satisfaction, business competitiveness, as well as on added business value which offers to customers (Korpela and Tuominen, 1996). Researchers in this field focused on “what should be done” and they did not pay attention on “how to do it” (Zviran, 1990).

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Current business environment is getting more and more turbulent as well as competitive, so an effective and timely decision-making is necessary and the implementation of decision support technology is becoming crucial. Decision support technology can restrict complexity and improve efficiency in the decision-making process. Several researchers have studied the efficiency and effectiveness of Decision Support Systems (DSS) (Alalwan, 2013). DSS are used to identify the effect of strategic issues on the logistics and to determine the most effective processes to be performed because of the strategic issues with the highest either positive or negative effect on the logistics (Korpela and Tuominen, 1996).

Previous researches in this field highlight the benefits of using computer-based systems to maintain logistics management, especially in transportation and warehousing (Accorsi et al., 2014; Moynihan et al., 1995). Furthermore, previous surveys were focused on the technical aspect of the DSS development and they did not take into consideration the strategic one (Fanti et al., 2015; Kondratenko et al., 2013; Sansone, 2014; Songbai et al., 2010; Wong 2012).

The purpose of this paper is to propose a strategic DSS framework which combines both the strategic management process and the Strategic Information Systems Planning (SISP) process in order to provide a holistic approach for effective decision making in Logistics.

The rest of the paper is structured in 3 sections. Section 2 describes the theoretical background based on which the conceptual framework presented and discussed in Section 3 has been developed, while Section 4 summarizes some concluding remarks.

2. Theoretical Background

2.1 Literature Review Methodology

A methodology suggested by Webster and Watson (2002) for implementing systematic literature review in the field of IS was followed in order to search relative papers and provide a structured literature review. First, a search of the extant literature reviews was done to select the databases and keywords of the basic search. Then, the backward search was implemented to examine the references of the selected papers and finally the forward search to examine the citations of the selected papers in order to increase their amount. After the selection of the papers, these were classified according to their content.

Searching was done in Scopus, Science Direct, Web of Science and ABI/INFORM databases using keywords, "Decision Support Systems and strategy", "Decision Support Systems and Logistics", "Decision Support Systems and Supply Chain Management" and "strategic information systems and planning". Selected articles were in English and were published in scientific journals and conferences.

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When the searching was completed in all databases, titles and abstracts of the relevant papers were scanned. Then the citations and references of the selected papers were reviewed. 123 papers compose the final sample (Figure 1).

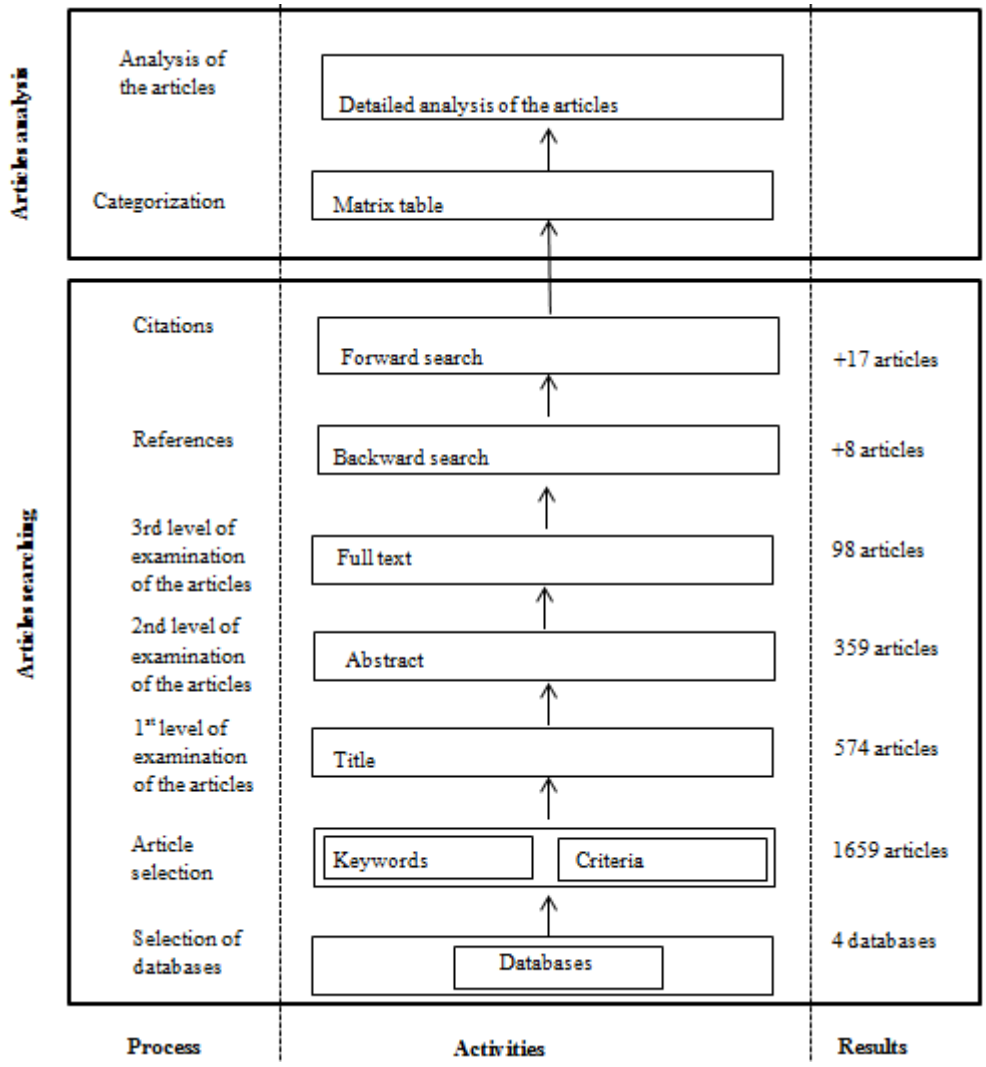

Figure 1. Searching process

Papers were categorized to three categories according to their concept. These categories were Strategic Information Systems Planning, Decision Support Systems and Decision Support Systems in Logistics. The findings of the papers are presented in the next sections.

2.2 DSS Models and Strategy

In the current environment which is continuously changing, nobody can refuse the significance of strategic management. Businesses need to analyze their current situation, predict their future position, formulate goals and objectives and define how they will achieve them. In this way, they will be able to compete successfully in the market. Strategic management is the process through which managers develop and

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sustain competitive advantage for their businesses (Waxlax, 1993; Yoo and Digman, 1987).

Strategic management includes four basic activities, named; strategic analysis, strategic choice, strategy implementation and strategy evaluation. In the first one, managers analyze the current internal and external business environment. Next, they identify strategic alternatives which support the business to achieve business goals and objectives, taking their available resources into account. In the second activity, managers formulate and evaluate different strategic action alternatives. Managers re-examine all important hypothesis of each alternative and estimate the trade-off between risk and reward. In this activity managers have to be sure that no apparent possible strategy has been overlooked and limiting the alternative choices. Finally, managers evaluate if the strategy is implemented as it was firstly defined and if the intended goals are achieved (Applegate et al., 1986; Moormann and Lochte-Holtgreren, 1993; Waxlax, 1993; Yoo and Digman, 1987).

Information is necessary for top level managers in order to analyze and select the best strategy. Information about technology, economic conditions, government, culture, industry, raw materials, human resources, financial resources, and market are necessary for the implementation of effective management. This information support businesses to define objectives themselves, to formulate policies, to achieve goals, to communicate the results of strategic actions of the business to stakeholders, to develop long-term plans, to examine opportunities and treats, to dispense capital resources and to define product price (Calhoun et al., 2002; Yoo and Digman, 1987).

IT can be used both to collect information and to support the decision making in order to select the right strategy. A category of a computer based system which can be used to support decision making is DSS. A DSS is defined as "*an interactive, flexible and adaptable Computer Based Information System which uses decision rules, models and model base as well as a database and the decision makers apply decisions in solving problems which would not be willing to manage visualization models per se*" (Waxlax, 1993). DSS help managers making decision in semi-structured problems, in order to evaluate and improve both the effectiveness and the efficiency of decision making (Moormann and Lochte-Holtgreven, 1993; Yoo and Digman, 1987).

Yoo and Digman (1987) proposed a DSS model for strategic management. The first one, named "Environmental Analysis Subsystem", is used for gathering information such as inventory, production, R & D, marketing, industry, raw materials, human resources, financial resources, market, technology, economic conditions, government and culture necessary for forecasting and projecting both the external and internal business environment. The second subsystem is the "Goal-setting Subsystem" which includes a model base which generates alternatives models. One or more of them are selected according to determined goals and objectives as well as business's mission and purpose. In the Goal-setting subsystem the results of the evaluation phase should

be used as an input as well as in the strategy operating subsystem. Furthermore, the results of each phase of the strategic management process can be used as an input in the strategy operating subsystem for reparative actions and future effectiveness. Next, Decision Support Subsystem involves a DSS database, a DSS model base and application programs which support the flow of information within the system. The DSS database includes files of historical, managerial and environmental data as well as files on various transactions. The DSS model base involves models which are useful for the solution of strategic problems. The last subsystem is the "Strategy Operating Subsystem", in which the decision maker defines, evaluates and selects alternative strategies. Then, he implements the selected strategy, and evaluates it based on information provided by the decision support subsystem.

Similarly Moormann and Lochte-Holtgreren, (1993) presented a Group Decision Support System for strategic planning based on the main activities of the strategic process; Environment Analysis, SWOT Analysis, Culture Analysis and Evaluation. The main challenge was that the strategic planning process was not included in each phase of the strategic planning.

Honby et al., (1994) presented a DSS model based on six essential elements of the strategic planning process; setting organizational objectives, developing capabilities to attain objectives, formulating comprehensive strategies, developing specific programs of action, implementing organizational policies and finally aligning programs of action with objectives. This model does not present the database and the technical aspects of the system. Furthermore, it is based on these six elements which are essential for strategic planning but they do not include the environmental analysis which is a significant element, too.

Table 1 summarizes the existing strategic actions including in DSS. As decision makers need to gather and store information in order to formulate strategic plans and generate reports, the main challenges in the development of strategic DSS are the required skills for the development and the alignment between business strategy and technology in order to make strategic plans to work. Also, it is important managers to identify the reasons and the goals that the development of the DSS is necessary (Rebai et al., 2011; Yoo and Digman, 1987). Moreover, DSS should be flexible, deal with various environments and organizational settings, easy to use by managers and finally help strategic planners in identifying the role and importance of IS to the organization (Zviran, 1990).

Strategic Actions including in DSS	**References**
Identification of environmental trends, internal trends and performance trends	Korpela and Tuominen, (1996)
Assessing the impact and urgency of the issues, and prioritizing the issues	
Planning responses to the issues	

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Environment Analysis	Moormann and Lochte-Holtgreren, (1993)
SWOT Analysis	
Culture Analysis	
Evaluation	
Environmental Analysis Subsystem	Yoo and Digman (1987)
Goal-setting Subsystem	
Strategy Operating Subsystem	

Table 1. Strategic Actions including in DSS

To conclude, Strategic Decision Support Systems (SDSS) should support each phase of strategic management process. Businesses need to know what data are necessary to be collected. This is often relagated as strategic knowledge acquisition. Information will help them make decisions which are profitable. The information collected from external environment is not usually well-structured. Thus, the advantages of informed decision making using DSS are significant (Alyoubi, 2015).

2.3 Logistics Strategy

Businesses consist of important functions which have their own strategies. Logistics is a holistic approach to the management of material and information flows which has strategic impact on business (Korpela and Tuominen, 1996). Researchers have recently paid more attention in the strategic role of logistics. Logistics strategy must be aligned with business strategy because it determines the selection of products, services and markets and identifies the objectives of the logistics system of the business (Korpela and Tuominen, 1996; Shi et al., 2015). In this section, authors explore the logistics strategic management process by integrating the concepts of strategic planning.

As managers in strategic planning identify the main objectives for the business in order to compete businesses in a turbulent environment, the logistics strategic planning process starts with situational analysis which includes the formulation of the vision, strategic goals, objectives, strategies and action plans. The purpose of this analysis is to determine the strengths, weaknesses, threats and opportunities by analysing both the logistic system and the business environment. Furthermore, an analysis of strengths and weaknesses provides results in logistical structure and logistical costs, inventory management, transportation, IS, organizational structure, cooperation with other corporate functions and materials handling and transportation. The scanning of the environment and the development of resources are important to determine the long-term direction for the logistics function (Korpela and Tuominen, 1996).

Specifically, the vision, describes a desired future situation defined for the logistics organization. The objectives and strategies enhance the translation of logistics vision in specific performance measures and operating models such as customer service, transportation, order processing, inventory management, warehousing, IS and

organization. The identification of objectives and the formulation of strategies are aligned with other corporate functions like marketing and production to increase business advantages. Moreover, action plans consists of a detailed description of the operational and short-term activities that are necessary for the implementation of the strategy (Korpela and Tuominen, 1996).

So, managers need information regarding the trends and the assessment of the impact and urgency of the determined trends, the assessment of priorities and the development of a plan with responses to the issues. Managers need information in order to make decisions which will help them to increase of the reliability of the logistics chain, the flexibility of logistics, to reduce the logistics costs at the required customer service level and to improve the quality of the logistics activities (Korpela and Tuominen, 1996).

2.4 Strategic DSS Models in Logistics

Previous researches in this field focus on the significance of IT to support decision makers to make more efficient decisions and to improve their effectiveness. Specifically, previous surveys highlight the benefits of using computer-based systems to maintain logistics management, especially in transportation and warehousing. Limited surveys have been implemented in the fields of inventory and product forecasting (Accorsi et al., 2014; Moynihan et al., 1995; Naseem et al., 2017). In this section the existing DSS models for transport service, reverse logistics, warehouse design and performance, third part logistics and supplier selection are presented. The aim of this section is to position the current conceptual model with regard to the existing knowledge about strategic DSS models in Logistic and to identify specific research questions to be asked.

Korpela and Tuominen, (1996) developed a DSS for the strategic issues management of logistics activities based on the principles of the Analytic Hierarchy Process (AHP) in order to present a hierarchy of the goals and the expected results. They tried to define the most effective actions to be carried out in response to the strategic issues with the highest either positive or negative impact on the company. The presented DSS focuses on the information which are required in order to estimate how stable the established results are with regard to changes in the priorities in the hierarchy,

Similarly, Fanti et al., (2015) presented a DSS for the tactical and the operation levels using a case study in sea transport. They focused on the technical elements of the system and they did not align it with the strategic management process.

The previous problems could be dealt with the design of a flexible logistical structure, the implementation of combined transport and steering systems as well as the strategic alliances with transportation and forwarding businesses. The design of a flexible logistical structure could be achieved by limiting the high volume of transport roots

and modes and by using alternative routes and modes. Thus, the combined transport would be useful where rail transports are to be used for long distances and road transports only for local deliveries. In this view, steering systems should be considered for free transport routes and modes, because transport fees are a serious problem for logistics (Korpela and Tuominen, 1996).

The above problems can be avoided by the development of IS that allows the production of real-time information on vehicles and goods. It also increases the added-value services based on communication and control of carriages and customers for safety and productiveness purposes. The reduction of Empty Load Ratios supports the minimization of the logistics costs, energy and infection (Hu and Sheng, 2008).

As transportation and freight consolidation are significant issues in the shipment process, the logistics providers have to formulate strategies for effective transportation systems which seek to maximize the value of their services. These strategies concern the understanding of the service needs of customers and the reduction of delivery prices. If a product is non-available at a specific time to customers, then expectations such as lost sales, customer dissatisfaction and production downtime are inevitable (Salam and Khan, 2016).

Turki and Mounir (2014) developed a web-based DSS in order to handle the returned products but they did not align the goals of the system with business goals. Furthermore, the practitioners were not based on relative strategic phases regarding the handling of the returned products in reverse logistics. They only present the returned products handling process. This survey indicates that the main purpose of logisticians is to reduce the environmental impacts of the supply, production, distribution and returns. The problem of returns and wastes treatment includes products return activities as well as packaging and any needs for special adjustment.

The reverse logistic determines a flow from the customer to the producer. This flow concerns the planning, the implementation and the control of unsold products, the sending repairs, the returns of the promotional products or the returns because of the failure of the organization systems, as well as the waste which increases the environmental pollution. The waste is classified according to their origin into household wastes, industrial wastes, health care activity wastes, inert waste and radioactive wastes (Rebai et al., 2011; Turki and Mounir, 2014).

The existing DSS take into consideration only costs and therefore cannot quantify the impact on corporate profitability of various alternative scenarios. An important limitation is that they are not user friendly, which is perceived as the most significant criteria for managers who use them. Also, they focus on the individual components of the overall system, and thus ignore the integrated approach. So, they fail to provide the strategic planner with the optimal results and help them to make effective decisions (Moynihan et al., 1995). The visualization with DSS provides several

advantages to the development of logistics function because it reduces the total order cycle time and the transportation cost (Salam and Khan, 2016).

Another significant issue concerns the development of DSS for warehouse. Undoubtedly, the customer needs have dramatically changed due to order accuracy, frequency, quantity, size and response time, as well as the new demand trends, such as the expansion of e-commerce. First, warehousing systems receive products from inbound or manufacturing lines, and then they store materials. When these materials are requested, they export products from inventory and deliver them to the customers. The main decisions that have to be taken concerning about the design of a warehouse are, how much inventory should be needed for an order and where should it be stored?

Previous surveys which combine warehouse design and DSS are limited. The design of a warehouse can be supported by DSS which make strategic decisions about the storage equipment and the high level of facilities, put-away, replenishment and order picking. Information regarding zoning, batching and routing, existing models, techniques and methodologies are required for the development of the DSS for warehouse design. Previous surveys highlight that a DSS which can gather data from real-world circumstances and implement effective heuristics in order to enhance the decision process on warehousing management is necessary. The illustration of an innovative architecture of DSS will support the analysis of warehousing systems, taking the layout features, storage equipment, allocation problems and evaluation into consideration. The development of this architecture is supported by numerical simulations to estimate results, statistics and performances (Accorsi et al., 2014).

The warehouse design is based on historical inventory and customer demand data. The development of the facility layout is based on the shape factor, the number of aisles, the number of bays per aisle, the rack sizes and types and the characteristics of the unit load. Also, DSS enhance decisions about the assessment of warehouse performance using KPIs, such as the storage capacity, the response time, the cost rate and the cost per unit of material flow. Furthermore, DSS support the comparison between different configurations and scenarios using a user-friendly computer environment and multi-dimensional scenarios. These scenarios concern the selection of the stock level for each SKU and impact on both replenishment activities and picking processes. Also, hypothetical scenarios help the decision-maker to make the best solution for the warehouse design concerning the minimization of the total travelling distance, time and cost (Accorsi et al., 2014; Naseem et al., 2017).

So, inputs in the DSS could be operative features, costs and other general parameters and outputs include KPIs, such as the pick-rate and time/travelling for picking. DSS contains a SQL database which allows users to collect, store and handle data quickly. Also, graphical 3D views of warehousing scenarios are optimized to support the results of the decision process. It is obvious that researchers focus on the technical

aspect of the DSS and they avoid to combine the development of the system with the strategic planning of the warehouse design.

Third part logistic (3PL) managers deal with multiple-client storage systems, described by high-variability in items, storage racks and turnovers. DSS support decision makers to handle strategic decisions, based on the estimation of parameters, such as costs for racks and storage equipments (Accorsi et al., 2014). As the choice of a suitable strategic partner needs the understanding of many qualitative and quantitative criteria, such as globalization considerations, the relationship development and integration competencies, the operational performance, the quality, the finance and IT, DSS have been implemented to support the selection process (Wong 2012).

Another area of Logistics where DSS are used focuses on the evaluation of supply chain. Current changes in global production have intensified supply chain complication and increased the argument that logistics strategies are significant aspects of business strategy. Recent business environment highlights the need for supplier relationship development to improve businesses sustainable management. The purpose of the supplier selection and assessment process is to limit risk and increase overall value to the customer. As supplier selection is considered to be a multiple criteria decision-making process, this process is an even more confused problem. The decision-maker needs to analyze a large amount of data considering multiple factors in order to apply a more effective evaluation. Businesses have to pay attention in each factor to reduce the costs and to increase their profit, because of the increased globalization of trade and the expansion of competition. Businesses formulate strategies concerning the supplier selection process paying attention to the sustainability and environmental responsibility requirements, in order to deal with the higher level of competition. Several researchers argue that sustainability is a significant aspect which has to be considered by managers in supplier selection and performance evaluation (Karthik et al., 2015). DSS which have been developed for the supply chain assessment focus only the criteria which should be taken into consideration by decision makers and they are not aligned with the strategy process.

Businesses focus on the advantages and risks and visualize the outsourcing results to support their long-term competitive advantages. The outsourcing process includes several advantages, such as lower cost, increase on investment on core functions, flexibility, decrease of financial assets and supplementary capabilities (Karthik et al., 2015).

The development of a computer aided system can be utilized by spreading knowledge among logistic providers, practitioners and managers. Also, it can be exploited by educating and enhancing industrial engineer expertise as well as by examining real-world case studies. Thus, DSS support managers and decision-makers who have limited skills and knowledge in programming and software development but deal with

warehousing system design and management problems, provide a useful and user-friendly tool for effective decision making process (Accorsi et al., 2014).

DSS support all the stages of the decision making process, beginning with gathering data from the environment. Then, possible alternatives of action are created, developed and evaluated. Finally, an alternative is selected and it is evaluated (Yoo and Digman, 1987). Despite the importance of DSS in the functions of supply chain and logistics, limited systems were aligned with the activities of business strategy. Researchers have focused only on the technical aspect of the systems ignoring to follow a formal process for the DSS planning and development. Thus, one challenge for researchers is how to integrate the logistics strategy planning with the development of DSS for logistics functions. Another significant challenge which has not been mentioned by researchers yet is how to organize the team will develop the system. Managers have to cooperate with employees with technical skills who will be informed about logistics strategy and they will integrate it in the system's functions.

3. Conceptual Model

The significance of SISP and its alignment with business planning has been defined as a major issue to improve business success and IS performance. So, it is a field of interest to IS managers. IS managers deal with SISP which is a significant challenge today. Effective planning is important to comprehend the role and significance of IS and perceive their strategic impact. This process includes the definition of business's characteristics, the formulation of business's critical success factors, the description of important issues concerning the role and significance of IS, the selection of business goals as well as the determination of IS goals, the production of preliminary output, the performance of sensitivity analysis and suitable opportunities and the production of a draft for IS strategic plan (Zviran, 1990).

The proposed model (Figure 2) is based on previous Strategic DSS, as they have been presented in the previous sections, and combines the phases of SISP process in order to suggest a completed model for strategic decisions in Logistics. The model includes four categories of subsystems, named; Environmental Analysis Subsystem, Goal Determining Subsystem, Decision Support Subsystem and Strategic Information Systems Planning Subsystem (Yoo and Digman, 1987; Zviran, 1990).

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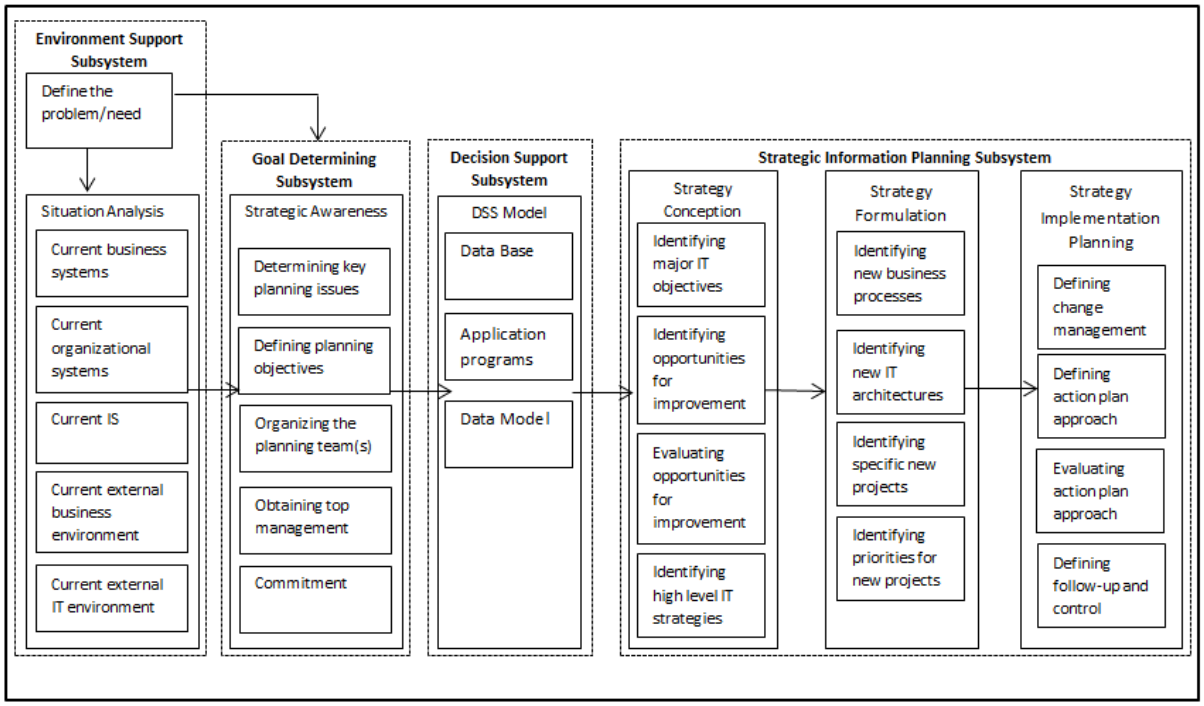

Figure 2. Proposed Model for Strategic Information Systems Planning using SDSS in Logistics

The first subsystem involves the identification of the problem, in order the business to make the appropriate decisions. The Situation Analysis is the first phase of SISP process and it is involved in this subsystem. Generally, in the current phase, managers analyze the current business environment. Also, businesses analyze the current external IT and business environment to identify new trends in IT. Managers analyze strengths and weaknesses concerning economic conditions, logistical structure and logistical costs, inventory management, transportation, warehousing, IS and materials handling (Brown, 2004; 2010; Dooley and O'Sullivan, 1999; Kamariotou and Kitsios, 2018; 2017; 2016; Kamariotou et al., 2017; Kitsios and Kamariotou, 2017; 2016; Maharaj and Brown, 2015; Mentzas, 1997; Mirchandani and Lederer, 2014; Newkirk and Lederer, 2006; Newkirk et al., 2008).

In the second subsystem, the second phase of SISP is included. Strategic Awareness, involves key planning issues concerning the determination of objectives and the development of the team which will participate in the implementation phase of the process. The main objectives which have to be identified are related to customer service, transportation, order processing, inventory management, warehousing, the lack of cars with petroleum, the increase of the use of low fuels air and sea transport and the increase of rail and naval transport. Top managers take part in each stage of the process. They support, encourage and evaluate the process (Brown, 2004; 2010; Dooley and O'Sullivan, 1999; Kamariotou and Kitsios, 2018; 2016; 2017; Kamariotou et al., 2017; Kitsios and Kamariotou, 2017; 2016; Maharaj and Brown, 2015;

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Mentzas, 1997; Mirchandani and Lederer, 2014; Newkirk and Lederer, 2006; Newkirk et al., 2008).

Then, Decision Support Subsystem contains Data Base, Data Model and Application programs. The previous two subsystems provide information to the Decision Support Subsystem. Next, this subsystem generates an output which is used as an input for the next subsystems. Thus, managers can gather, store and reclaim the necessary information about external and internal environment and historical data (e.g. about transportation or supplier selection and evaluation), which will help them to create alternative scenarios. Then, managers will evaluate this information and they will select the best choice, which will be developed in the next subsystem. The output of this subsystem includes alternative decisions about drivers' and vehicle transportation, KPIs, cost rate, cost per unit of material flow. Data can be stored for further working out and sensitivity analysis. They can also be categorized in external files if further processing is required. The user interface helps this process by providing a set of menus and question/ answer dialogues (Zviran, 1990). Once the problem is defined, mathematical models based on the problem are implemented that support the development of alternate solutions. Next, the models are created to analyze the alternatives. Then, the selection of the most suitable alternative follows. Overall, several methods, models, theories and algorithms are implemented to develop and analyze the alternative decisions in DSS. Examples of these techniques are the intelligent analysis of data and the fuzzy theory.

Some basic features have to be considered for the development of the systems. DSS include several basic components as follows. Firstly, the data component usually includes a Database Management System (DBMS). The DBMS includes modeling tools and general programming languages. Data used can either be internal or external, either cross-sectional data or time series. Internal data come from organization's internal functions and concern products and services prices, financial data, recourse allocation data, data related to costs such as payroll cost or cost-per-product. External concern is about competition market share, government arrangements and anything that comes from external sources such as market research, government agencies, and the web. Data are stored in the database. These data are used as an input of variables in the optimization of models. Data stored in the DSS database are provided by other data files, which could be business's internal or external files. The next component is the model component. This component contains a simulation model, a mathematical model as well as optimization algorithms which support the analysis of the impact of the selections on the system performances (Fanti et al., 2015; Yoo and Digman, 1987). Precisely, several methods, models, theories and algorithms are implemented to develop and analyze the alternative decisions in DSS. Examples of these techniques are the intelligent analysis of data, the simulated and fuzzy modeling, the use of genetic algorithms and neural networks, the decision making theory and fuzzy theory (Kondratenko et al., 2013).

The third one is the interface component. This component is responsible for the communication and interaction between the system and the decision makers. The fourth component is the decision component. This component includes two second level classes. The first one is the operational decision class and the second one is the tactical decision class. Furthermore, these classes contain the performance indicators which decision makers have to take into consideration to make decisions (Fanti et al., 2015).

Strategic Information Systems Planning Subsystem contains the last three phases of SISP. In Strategy Conception the identification of important IT goals and objectives for implementation are applied. The organizing team evaluates them and formulates the technological strategy which will be implemented in the next phase. Next, there is the Strategy Formulation phase through which the identification of new IT architectures, processes, projects and the priorities over them are implemented. Finally, Strategy Implementation Planning includes activities concerning changes in management process, such as the implementation of the opportunities, the objectives, the plans and the new processes, the action plan, its evaluation and control (Brown, 2004; 2010; Dooley and O'Sullivan, 1999; Kamariotou and Kitsios, 2018; 2016; 2017; Kamariotou et al., 2017; Kitsios and Kamariotou, 2017; 2016; Maharaj and Brown, 2015; Mentzas, 1997; Mirchandani and Lederer, 2014; Newkirk and Lederer, 2006; Newkirk et al., 2008).

4. Conclusions

The combination of strategic planning with DSS is a new research area. It can significantly improve the strategic decisions' effectiveness. Formal design is important to obtain the advantages of Strategic DSS. Further expansions in DSS research area and IS will provide new motivations for successful Strategic DSS planning and development (Moormann and Lochte-Holtgreven, 1993).

DSS are based on the needs for information of the existing organizational functions. In the future, DSS will try to include tools, based on environmental changes and information needs, which will support decision makers so as to adapt their working practice for future demands (Salmela and Ruohonen, 1992).

A framework which combines SISP process and DSS in Logistics is suggested. This paper contributes twofold. Firstly, it bridges the gap in the literature regarding the connection between SISP process and DSS. Furthermore, it suggests a new framework for decision making in logistics which presents the planning of the DSS through a formal process which integrates the business strategy with the IT strategy.

By defining the phases that support managers so as to make decisions for their businesses, implications for future research are presented. Academics and managers should expand, visualize and test this model, to evaluate the effectiveness of SISP

phases in the process of decision making. As the framework has not been tested yet, the results of an exploratory study will be summed up in an expanded conceptual model for future research.

References

Accorsi, R, Manzini, R and Maranesi, F. (2014) 'A decision-support system for the design and management of warehousing systems', *Computers in Industry*, Vol. 65 No 1, pp. 175-186.

Alalwan, J.A. (2013) 'A taxonomy for decision support capabilities of enterprise content management systems', *The Journal of High Technology Management Research*, Vol. 24 No 1, pp. 10-17.

Alyoubi, B.A. (2015) 'Decision Support System and Knowledge-based Strategic Management', *Procedia Computer Science*, Vol. 65, pp. 278-284.

Applegate, L.M, Konsynski, B.R and Nunamaker, J.F. (1986) 'Model management systems: Design for decision support', *Decision Support Systems*, Vol. 2 No 1, pp. 81-91.

Brown, I. (2010) 'Strategic Information Systems Planning: Comparing Espoused Beliefs with Practice' in *ECIS 2010: Proceedings of 18th European Conference on Information Systems*, Pretoria, South Africa, pp. 1-12.

Brown, I.T.J. (2004) 'Testing and Extending Theory in Strategic Information Systems Planning Through Literature Analysis', *Information Resources Management Journal*, Vol. 17 No 4, pp. 20-48.

Calhoun, K.J., Teng, J.T. and Cheon, M.J. (2002) 'Impact of national culture on information technology usage behaviour: an exploratory study of decision making in Korea and the USA', *Behaviour & Information Technology*, Vol. 21 No 4, pp. 293-302.

Dooley, L and O'Sullivan, D. (1999) 'Decision support system for the management of systems change', *Technovation*, Vol. 19 No 8, pp. 483-493.

Fanti, M.P, Iacobellis, G, Ukovich, W, Boschian, V, Georgoulas, G and Stylios, C. (2015) 'A simulation based Decision Support System for logistics management', *Journal of Computational Science*, Vol. 10, pp. 86-96.

Hornby, R.E., Golder, P.A. and Williams, J. (1994) 'SDP: a strategic DSS', *Decision Support Systems*, Vol. 11 No 1, pp. 45-51.

Hu, Z.H and Sheng, Z.H. (2014) 'A decision support system for public logistics information service management and optimization', *Decision Support Systems*, Vol. 59, pp. 219-229.

Kamariotou, M and Kitsios, F. (2016) 'Strategic Information Systems Planning: SMEs Performance outcomes' in: *Proceedings of the 5th International Symposium and 27th National Conference on Operational Research*, Athens, Greece, pp. 153-157.

Kamariotou, M and Kitsios, F. (2017) 'Information Systems Phases and Firm Performance: A conceptual Framework', in Kavoura, A. et al, (Eds.), Strategic Innovative Marketing *Springer Proceedings in Business and Economics*, pp. 553-560.

Kamariotou, M, Kitsios, F, Madas, M, Manthou, V and Vlachopoulou, M. (2017) 'Strategic Decision Support Systems for Logistics in the Agrifood Industry' in: *Proceedings of 8th International Conference on Information and Communication Technologies in Agriculture, Food & Environment*, Chania, Crete, Greece, pp. 781-794.

Kamariotou, M and Kitsios, F. (2018) 'Strategic Information Systems Planning', In: Mehdi Khosrow-Pour (Ed.), Encyclopedia of Information Science and Technology, Fourth Edition, *IGI Global Publishing*, chapter 78, pp. 912-922.Karthik, B, Raut, R.D, Kamble, S.S, Kharat, M.G and Kamble, S.J. (2015) 'Decision support system framework for performance based evaluation and ranking system of carry and forward agents', *Strategic Outsourcing: An International Journal*, Vol. 8 No 1, pp. 23-52.

Kitsios, F and Kamariotou, M. (2017) 'Decision Support Systems and Strategic Information Systems Planning for Strategy Implementation'. in: Kavoura, A., et al., (Eds.), *Strategic Innovative Marketing, Springer Proceedings in Business and Economics*, pp. 327-332.

Kitsios, F and Kamariotou, M. (2016) 'Decision Support Systems and Business Strategy: A conceptual framework for Strategic Information Systems Planning', in *ICITCS 2016: Proceedings of the 6th International Conference on IT Convergence and Security*, Prague, Czech Republic, pp. 149-153.

Kondratenko, Y.P, Klymenko, L.P and Sidenko, I.V. (2014) 'Comparative Analysis of Evaluation Algorithms for Decision-Making in Transport Logistics', *Advance Trends in Soft Computing*, pp. 203-217.

Korpela, J and Tuominen, M. (1996) 'A decision support system for strategic issues management of logistics', *International journal of production economics*, Vol. 46, pp. 605-620.

Maharaj, S and Brown, I. (2015) 'The impact of shared domain knowledge on strategic information systems planning and alignment: original research', *South African Journal of Information Management*, Vol. 17 No 1, pp. 1-12.

Mentzas, G. (1997) 'Implementing an IS Strategy- A Team Approach', *Long Range Planning*, Vol. 30 No 1, pp. 84-95.

Mirchandani, D.A and Lederer, A.L. (2014) '"Less is More:" Information Systems Planning in an Uncertain Environment', *Information Systems Management*, Vol. 29, No 1, pp. 13–25.

Moormann, J and Lochte-Holtgreven, M. (1993) 'An approach for an integrated DSS for strategic planning', *Decision Support Systems*, Vol. 10 No 4, pp. 401-411.

Moynihan, G.P, Raj, P.S, Sterling, J.U and Nichols, W.G. (1995) 'Decision support system for strategic logistics planning', *Computers in industry*, Vol. 26 No. 1, pp. 75-84.

Naseem, A., Shah, S.T.H., Khan, S.A. and Malik, A.W. (2017) 'Decision support system for optimum decision making process in threat evaluation and weapon assignment: Current status, challenges and future directions', *Annual Reviews in Control*, Vol. 43, pp. 169-187.Newkirk, H.E and Lederer, A.L (2006) 'The effectiveness of strategic information systems planning under environmental uncertainty', *Information & Management*, Vol. 43, No 4, pp. 481-501.

Newkirk, H.E, Lederer, A.L and Johnson, A.M. (2008) 'Rapid business and IT change: drivers for strategic information systems planning?', *European Journal of Information Systems*, Vol. 17 No 3, pp. 198-218.

Rebai, N, Benabdelhafid, A. and Benaissa, M (2011). 'A Decision Support System Proposal in a reverse logistic environment' in *LOGISTIQUA 2011: Proceedings of the 4th International Conference on Logistics*, Tunisia, pp. 424-429.

Salam, M.A and Khan, S.A. (2016) 'Simulation based decision support system for optimization: A case of Thai logistics service provider', *Industrial Management & Data Systems*, Vol. 116 No 2, pp. 236-254.

Salmela, H and Ruohonen, M. (1992) 'Aligning DSS development with organization development', *European Journal of Operational Research*, Vol. 61 No 1, pp. 57-71.

Sansone, U. (2014) 'DSS And ITS For Intermodal Freight Transport: Some European Experiences', *WIT Transactions on Ecology and the Environment*, Vol. 191, pp. 803-813.

Shi, P, Yan, B, Shi, S and Ke, C. (2015) 'A decision support system to select suppliers for a sustainable supply chain based on a systematic DEA approach', *Information Technology and Management*, Vol. 16 No 1, pp. 39-49.

Songbai, H, Yajun, W, Dianxiang, Y, Yaqing, A and Ke, Z. (2010) 'The design and realization of vehicle transportation support DSS under contingency logistics' in *ICACC 2010: Proceedings of the 2nd International Conference on Advanced Computer Control*, Shenyang, Liaoning, China, pp. 463-466.

Turki, W. and Mounir, B. (2014) 'A proposition of a decision support system for Reverse Logistics' in *ICALT 2014: Proceedings of the International Conference on Advanced Logistics and Transport*, Tunisia pp. 120-125.

Waxlax, J. (1993) 'An object-oriented DSS for strategic management', *Computers & industrial engineering*, Vol. 25 No 1, pp. 573-576.

Webster, J and Watson, R.T. (2002) 'Analyzing the Past to Prepare for the Future: Writing a Literature Review', *MIS Quarterly*, Vol. 26, pp. 13-23.

Wong, J.T. (2012) 'DSS for 3PL provider selection in global supply chain: combining the multi-objective optimization model with experts' opinions', *Journal of Intelligent Manufacturing*, Vol. 23 No 3, pp. 599-614.

Yoo, S and Digman, L.A. (1987) 'Decision support system: A new tool for strategic management', *Long Range Planning*, Vol. 20 No 2, pp. 114-124.

Zviran, M. (1990) 'ISSPSS: a decision support system for information systems strategic planning', *Information & management*, Vol. 19 No 5, pp. 345-359.