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Sambracos, Evangelos and Ramfou, Irene

University of Piraeus

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Evangelos Sambracos[1], Irene Ramfou[2]

[1]*Department of Economics, University of Piraeus, Greece, sambra@unipi.*
[2]*Phd Candidate, University of Piraeus, Greece, iramfou@gmail.com*

Abstract

In today's world, transport management is a key strategic factor for the achievement of organizational goals such as economic efficiency and effectiveness. Likewise, transport decisions are important for the development and establishment of organizational policies aiming at enhancing competitiveness, customer satisfaction and profitability. Companies though must realize that in order to develop an efficient and effective transportation system within the context of their supply chain, they must be able to trace and evaluate the causality mechanisms between the transport function and their performance. The exploration of these subjects commences with a literature review in the fields of transportation, logistics and performance measurement. Following, we develop a theoretical framework for assessing the effect of transportation to organizational performance. Our main instruments for the development of our model are the Balanced Scorecard model and the Supply Chain Operations Reference model (SCOR). These performance systems are supplemented by various established measures aiming at the development of a theoretical framework, a measurement instrument for the performance assessment of transport choices and improvements.

Keywords: goods transport; performance measurement systems; performance metrics.

1. Introduction

Achieving organizational performance has always been the major goal behind companies actions and strategies. Consequently, the ways and means of accurately measuring performance is perceived as being an increasingly important field of research. According to Neely (2007) the ISI Web of Knowledge lists 6,365 scientific publications on performance measurement for the time period 2001–5, which translates to one new scientific paper appearing on the subject every seven hours of every working day. Yet, there is not a uniform and generally accepted definition about what performance and performance measurement is about, while they are often confused with the notions of profitability and productivity (Andersen and Fagerhaug, 2002, Tangen, 2004). In this paper we adopt the definition of Mentzer and Konrad (1991) who defined performance measurement as *"the analysis of both effectiveness and efficiency in accomplishing a given task",* or in simple words *"how well a goal is met".*

Effectiveness refers to the extent to which goals are accomplished and stakeholder requirements are met, it involves doing the right things, at the right time, with the

right quality and can be defined as the ratio between actual output and expected output. Efficiency is an input and transformation process matter, defined as the ratio between resources expected to be consumed and actually consumed that measures how economically the firm's resources are utilized when providing a given level of stakeholder satisfaction (Tangen, 2004, Neely et al, 2002).

Performance therefore is an umbrella term of excellence and includes profitability and productivity as well as other non-cost factors such as quality, speed, delivery, dependability and flexibility (Tangen, 2004). Although, each company strives to fulfill different types of performance Slack et al. (2007) recognized five basic performance objectives that are broad stakeholder objectives and apply to all types of operation. These include:

- quality: doing things right, eliminate mistakes, provide error free goods to customers that are "fit for their purpose",
- speed: doing things fast, minimization of delivery lead times, reduction of in-process inventories between operations,
- dependability: doing things on time, keeping delivery promises to customers,
- flexibility: the ability to change what you do, adapt to changing circumstances quickly, offer new products and adjust to new volume and delivery needs without disrupting the rest of the operation,
- low cost: doing things cheaply, pricing goods appropriately for the market and at the same time achieving high returns.

If we consider the "performance tree" as proposed by Lebas (1995) then the above attributes are the fruits of the tree that are valued not only by customers, but by other stakeholders as well since they produce wealth. They are the result of business processes, which constitute the trunk of the performance tree. Further, the quality of processes rests in part on the nutrients in the soil that include elements such as competence, partnerships with both customers and suppliers etc. (Lebas and Euske, 2007). Visualizing the performance creation process as a tree we are setting an exploratory question of whether goods transportation as a business operation could affect the performance of a goods producing and/or selling organization.

Transportation is a key business activity playing a connective role both intra and inter-organizationally. Internally, transportation connects separated activities that result in the conversion of resources into goods according to the needs and wants of the customer (Tseng et al., 2005). Transporting is required in the whole logistics chain since it facilitates the entire process of materials and products moving into, through, out of and back to a firm consisting of four main activities: inbound logistics, covering the movement of material received from suppliers, materials management describing the movement of materials and components within a firm, physical distribution referring to the movement of goods outward from the end of the assembly line to the customer and returns back from customers. Transportation is one of the six key logistics activities that drive total logistics costs along with customer service (including parts, service support and returns goods handling), inventory management (including packaging and reverse logistics), warehousing and storage, materials handling and procurement and order processing (including information management and demand forecasting) (Lambert et al. 1998). Compared to the other logistics costs, transportation cost is the largest cost component often comprising half of the total logistics cost (Thomas and Griffin, 1996).

Externally, transportation performs an intermediary role in the supply chain facilitating the physical flow of goods from where they are produced, to a point of destination where they are needed for use or resale. Hence, it is a business process that

spans organizational boundaries linking channel intermediaries of the entire supply chain and encompassing shippers at the input side and consignees at the output side (Lai et al., 2004).
Transportation is therefore part of a complex network of interrelated activities both in internal and external supply chains. The process of understanding how these activities are related, influence each other and translate to performance improvement is a difficult task. In order to uncover the ``mechanisms" behind this relationships we are exploring first how transportation interacts with other business operations so as to trace how possible changes in transport supply could affect the performance of a transport using organization (shipper). Transport supply can be altered via improvements that have to do with the expansion of transportation capital (infrastructure) or the establishment of new policies and technologies both aiming at the improvement of the transportation system's efficiency (lower cost) and effectiveness (better quality in terms of transit time and its reliability) (EU, 1997, U.S. DOT, 2006).
Considering the above, the main purpose of this paper is to explore the effect of transport changes in terms of cost, transit time and transit time reliability on the performance of the transport user (shipper). In section 2 we proceed with a presentation of the main findings of our literature review that have helped us build our theoretical framework that we further develop in section 3. We end our discussion with propositions for further research.

2. Literature Review

2.1 Some important clarifications

We consider it useful to make a distinction between the terms that we use in this paper and specifically the meanings of framework, model, system, measure and metric. Rouse and Putterill (2003) consider frameworks to be *"useful ways of thinking about systems for modeling purposes",* while systems are considered as *"collection of parts organized for a purpose"* (Coyle 1977) and models as *"representation of reality intended to be useful to someone in charged with managing and participating in that reality"* (Morecroft, 2007). Frameworks therefore are a good starting point for model building as part of theory development and assist in this process by clarifying boundaries, specifying dimensions or views and may also provide initial intuitions into relationships among the dimensions (Rouse and Putterill, 2003). Folan and Brown (2005) further distinguished between structural frameworks that aim at specifying a typology for performance measure management and the procedural frameworks that provide a step-by-step process for developing performance measures from strategy. Neely et al. (2002) pointed that "*a performance measurement system enables informed decisions to be made and actions to be taken because it quantifies the efficiency and effectiveness of past actions through the acquisition, collation, sorting, analysis and interpretation of appropriate data".* Accordingly, a performance measure can be defined as "*a parameter used to quantify the efficiency and/or effectiveness of past action"*, while a performance metric is a component part of a measure (Neely et al.,2002).
Our literature survey focused on existing intra-organizational performance frameworks and systems including logistics performance measurement ones and inter – organizational performance frameworks that have influenced our thinking.

2.2 Selective review of existing performance measurement frameworks

Intra-organizational performance measurement frameworks and systems aim at measuring performance of single organizations. Among the plethora of proposed frameworks we have focused on the so called "balanced" frameworks that include financial and non – financial measures of performance. These include, the Performance Measurement Matrix (Keegan et al, 1989) that categorizes measures in a 2x2 table as being "cost" or "non-cost", and "internal" or "external, the SMART (Strategic Measurement and Reporting Technique) Pyramid by Lynch and Cross (1991) that also includes internally and externally focused measures, the Results–Determinants framework (Fitzgerald et. al.,1991) that classifies measures into those that relate to results (competitiveness, financial performance) and those that focus on the determinants of those results (quality, flexibility, resource utilisation,innovation) reflecting the concept of causality between drivers of performance and outcomes. Kaplan and Norton (1992, 1996) introduced the Balanced Scorecard (BSC) that identifies and integrates four different perspectives in terms of looking at performance (table 1) with an intent to keep a balance between certain relatively opposing forces in strategy that include internal and external influences, leading and lagging indicators and measures, financial and non-financial goals, organizational silos focused on their own goals and an overarching framework of goals, finance priorities and operations (Nair, 2004). Brown (1996) in his input–process–output–outcome framework shows links performance measures between five stages in a business process - inputs, processing system, outputs, outcomes and goal - assuming that a linear relationship exists between them. Neely et al (2002) developed a stakeholder-centric view of performance measurement, the Performance Prism which is organised around five distinct but linked perspectives of performance: stakeholder satisfaction, strategies, processes, capabilities and stakeholder contribution.

Table 1. The four perspectives in a Balanced Scorecard (Kaplan & Norton, 1992,1996)

Perspective	View	Objective/Vision
Financial	Shareholder's	To succeed financially, by delivering value to our shareholders
Customer	Value Adding	To achieve our vision by delivering value to our customer
Internal	Process Based	To promote efficiency and effectiveness in our business processes
Learning and Growth	Future	To achieve our vision, by sustaining innovation and change capabilities, through continuous improvement and preparation for future challenges

Several studies have also focused on logistics performance measurement. Mentzer and Konrad (1991) reviewed logistics performance measurement practices and concluded that cost and customer service were the most common criteria for evaluating logistics criteria while the cost – benefit analysis is usually used. The major transportation measures were labor, costs, equipment, energy and transit time.

In 1994 Chow et al., conducted a literature review on logistics performance measurement and defined logistics performance as the extent to which goals such as cost efficiency, sales growth, profitability, keeping promises, no loss and damage, fair prices for inputs, social responsibility, customer satisfaction, job security and working conditions, on time delivery, flexibility and product availability are satisfied bearing in mind that there are specific trade offs between some of them. They also recognized a set of measures for logistics performance such as raw financial statistics, cost statistics, input/output measures and quality measures. Stainer (1997) provides a framework with logistics performance measures that include total productivity, quality of operation, flexibility, speed of operation and capacity utilisation. Bowersox et al. (1999) list five main areas of operational performance in logistics that include customer service, cost management, asset management, quality and productivity while Soosay and Chapman (2006) proposed several metrics for each area. Griffis et al. (2004) after conducting a literature review identified several performance indicators that include average line item fill rate, average backorder fill time, complete order fill rate, days order late, inventory turnover ratio, logistics costs per unit, missed sales due to stockouts, on time delivery percentage, order cycle time variability, percent error pick rate, weeks of supply.

Literature on the impact of transport improvements mainly focused on the effect improvements in cost and transit time will have on private sector productivity due to changes in logistics costs using mainly cost – benefit assessments and focusing not only on the effects transport improvements will have on cost but also on the structure of their logistics systems (Mohring and Williamson, 1969, NCHRP 342, 1991, NCHRP 2-17(4) (1995), FHWA, 2001, Lakshmanan and Anderson, 2002). For additional impacts that difficult to value in monetary terms CBA is often extended to a Multi-Criteria Assessment (ECMT, 2001).

Since transportation links participants of supply chains we proceeded to review inter-organizational performance measurement frameworks that expands the boundaries of a single firm and focuses on enhancing supply chain performance. According to Stevens (1989) a supply chain is a system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together via the feed forward flow of materials and the feedback flow of information. In line with Lee and Billington (1992) argument, these discrete parts of a supply chain do not lead to an improved performance if each is pursuing its goals independently. A number of authors has suggested a shift in mind away from the functional orientations and isolate internal functions and towards the development of an extended enterprise performance management system. Numerous frameworks have been proposed that have influence our work and include the work of Stewart (1995) who proposed an integrated supply chain with a systems architecture focusing on information flow from point-of-need to the point-of-use, the Supply-Chain Operations Reference (SCOR) model developed in 1996 by the Supply-Chain Council (SCC) aiming at mapping supply chains and supply chain activities using standard descriptions and interdependencies among the processes of plan, source, make, deliver (Stewart, 1997) and return (SCC, 2001). Beamon (1998) further supported the opinion in against single performance measures and proposed a framework with the use of three measures: resources, output and flexibility connected in an iterative circle (Beamon 1999). Holmberg (2000) focused on systems perspective, Lambert and Pohlen (2001) proposed a procedural framework that aligns performance at each supplier – customer pair within the supply chain that consists of 7 steps. Gunasekaran et al. (2001, 2004) developed a framework based on the four activities of plan, source, make and deliver

and categorized performance measures into operational, tactical and strategic groupings. Brewer and Speh (2000, 2001) developed a four-perspective model of the supply chain management process and they integrated it with the four perspectives of the balanced scorecard and Bhagwat and Sharma (2007) developed a balanced scorecard for supply chain management to discuss the several supply chain performance measures that have been proposed. Lai et al (2002, 2004) presented a self-assessment of SCP in transport logistics by assessing the perceptions of service providers in the three sectors of the transport logistics industry i.e., shippers,service providers and consignees using metrics on the basis of the SCOR model.

3. Framework development

3.1 Methodological position

Based on Blumer (1969), who defined methodology of science as the study of the principles that underlie scientific inquiry, we build our framework based on the methodological position of holistic systems thinking. According to Arbnor and Björn (2008) three overlapping philosophies make up the paradigmatic thinking behind the systems view: systems theory, holism and structuralism.
For Checkland (1993) a system *"embodies the idea of a set of elements connected together, which form a whole, this showing properties which are properties of the whole, rather than properties of its component parts".* From this perspective, activities in organizations are best understood when seen as holistic systems, where the various subsystems and processes are seen to interact via a web or relationships and constitute a whole. Furthermore, in systems theory, it is the system's structure (key interrelationships) that determines behavior, and if structure is well understood and explained then a greater insight into the behavior of complex phenomena can be achieved (Senge, 1992). Finally, according to structuralism all structural (patterned) relationships can be usefully exposed and explored in order to understand phenomena (Arbnor and Björn, 2008).
In our framework we follow the systemic approach and consider transportation not as an isolated activity, but rather a component of a system (organization) that interacts with other activities that ultimately influence its performance. The complex network of interrelated activities in supply chains makes it difficult to describe and understand how these activities are related and how they influence each other (Holmberg, 2000). Indeed, transportation influences and is influenced by other activities while there are several trade offs between them. In order to map such situations we use linear cause and effect links and causal loops that offer a special overview of business showing what is connected with what and how changes in one part of the system might propagate to others and possibly return. This way we can reveal interconnections both obvious and hidden, that mental models cannot easily receive and map (Forrester, 1961) but there is more to that. Causal loops also capture hypotheses about dynamic behavior, and since behavior is determined by structure, it is the network of balancing and reinforcing feedback loops that drive performance through time (Morecroft, 2007).

3.2 Structure of the framework

In our structural framework we consider transport changes in terms of cost, transit time and transit time reliability as exogenous ones that are the result of policies

outside the boundary of our system and want to map in a theoretical structural framework how these changes are expected to propagate and trigger performance. Based on BSC these changes are expected to have an impact on the internal business processes of the organization that will ultimately affect its financial performance. We base out thinking on BSC three principles that enable a company's BSC to be linked to its strategy (Kaplan and Norton 1996):

- every performance measure selected should be an element of a chain of cause and effect relationships that communicate the meaning of the business unit's strategy to the organization,
- there must be an appropriate mix of outcomes (lagging indicators) and performance drivers (leading indicators) that have been customized to the business unit's strategy,
- causal paths from all the measures on a scorecard should be linked to financial objective.

In order to study internal business processes we used the process categorization proposed by SCOR, namely plan, source, make, deliver and return (SCC, 2008). Planning includes the processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production and delivery requirements. Sourcing consists of the processes that procure goods and services to meet planned or actual demand. Make refers to the processes that transform product to a finished state to meet planned or actual demand. Deliver includes processes that provide finished goods and services to meet planned or actual demand, typically including order management, transportation management, and distribution management. Return consists of processes associated with returning or receiving returned defective, excess and Maintenance, Repair or Overhaul (MRO) products from Source and Deliver.

Neely et al (2002) in their Performance Prism proposed a "stakeholder mix" consisting of investors, customers, intermediaries, employees, suppliers, regulators, communities, pressure groups and alliance partners, whose satisfaction is critical for performance. In our framework we consider two types of stakeholders the investors that are primary concerned with the financial goals and achievements of the company, and all the others – customers, suppliers, regulators, community etc.

In order to uncover the causal relationships we consider performance measures proposed by existing frameworks. It is our purpose to create a generic framework that could be applied to any goods producing and/or selling company however simple or complex it is. In the remaining paragraphs we discuss each component of this framework.

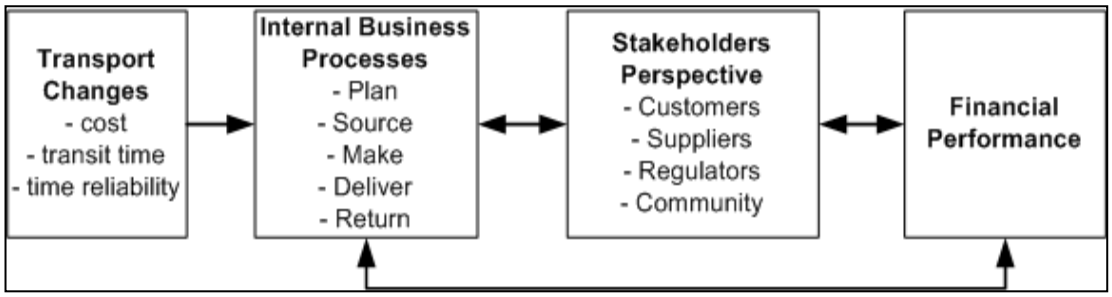

Figure 1: Generic framework

3.3. Transportation changes and internal business processes

We use SCOR's five primary business processes – plan, source, make, deliver, return- in order to examine the possible cause and effects relationships between transport changes and internal business processes. To do so we consider the effect of transport changes on specific measurement measures and metrics.

Planning determines the manner in which the resources flow through the operating system of the company. Therefore measuring and improving the effectiveness of planning and scheduling techniques will improve the performance of a supply chain (Gunaskaran, 2001). The process of planning is further decomposed to to plan supply chain, plan source, plan make, plan deliver and plan return (SCC, 2008).

Planning supply chain refers to the forecasting of demand, the identification of existing resources and the development of plans to balance resources with requirements (SCC, 2006). Transportation cost, time, reliability are, among others factors, affecting the level of expected demand and therefore any change can affect demand forecast accuracy (Hugos, 2003). At the same time, transportation is a resource for a company affecting its adequacy to satisfy demand. Demand forecast accuracy and transportation capacity are inputs to expected demand for materials used in the processes of planning in source, make, deliver and return.

Planing in source refers to the development of procurement plans. Johnson et al (1999) categorizes inbound movements into purchasing for use in manufacture and for resale, while adding a third category that includes returned goods for several reasons (reuse, disposal, recycling etc.). In the first case demand for production materials is depended on the company's schedule of production and calls for a requirements approach such as MRP (Material's Requirements Planning) and JIT (Just In Time) (Muller, 2003). In both systems transit time and its reliability plays a vital role since they both call for consistent material Replenishment Cycle Times (RCT), that is the time that elapses between the placing of an order to the supplier and its receipt (Johnson et al, 1999). On the other spectrum, in the case of purchasing for resale, demand is influenced by exogenous market conditions (independent) and call for a replenishment approach. The Reorder Point (ROP) and the Economic Order Quantity (EOQ) formulas are mostly used in order to approximate the optimum order point and order quantity (Muller, 2003). In the ROP formula RCT is taken into account, while for the EOQ formula to work RCT must be known and stable (Lambert, 1998). Additionally, the EOQ formula considers trade offs between transportation costs, ordering costs and inventory holding costs .

Planning in make refers to the process of building a Master Production Schedule (MPS) based on actual production orders and replenishment orders (demand) taking into account any possible capacity constrains (production, warehouse, transportation). MPS tells what products are to be produced, in what quantity, and what product must be ready for delivery, taking into account the existing inventories (Kumar and Suresh, 2008). Transportation capacity is affected by transportation cost and time and can put constraints to production.

Planning in deliver, is conducted through the development of a Distribution Resource Planning (DRP) that takes into account the Master Schedule (MS) for distributions that identifies product requirements stemming from demand and plans replenishment orders to the higher echelon in order to meet them, the Bill of Distribution (BOD) that contains the distribution network structure of a product and the lead time that includes transporting (LT) associated with each link in the BOD (Ho,1990, Ross, 2004). The scheduler then would assign gross requirements (product demand) to transportation

means on specific dates and quantities and create a shipping schedule (Bookbinder and Heath, 1988).
Planning in return refers to the process of aggregating planned returns and generating a Return Resource Plan (RRP) (Bolstorff and Rosenbau, 2007). Yet this is a very difficult task due to the uncertainty regarding the reason of return (and therefore the further use of the returned item), the amount of returned products and the time of the return. In the case of returned products that can be reused then the finished goods inventory and consequently the MRP system could be affected and also in the case of reproduction the MPS (Fleischmann et al., 1997). Also the materials inventory could be affected in cases where returned products are used after dis-assembly as materials for production. If returns can be associated with demand – this stands mainly for handling materials, packages and repairs – then planning can be achieved. In cases of stochastic demand for returns then the whole procedure cannot be easily patterned (Guide, 1996, Guide et al., 1997).
Sourcing refers to the process of obtaining the right materials, at the right place, at the right time, at the right quantity, at the right condition/quality from the right supplier and at the right price (Lambert et al., 1998). We use the metric Replenishment Cycle Time (RCT) to measure time that includes (Lamber, 1998):

Replenishment Cycle Time :	Order preparation and transmittal
	+ Order receipt and entry into supplier's system
	+ Order processing
	+ Order picking/production and packing
	+ Transit time
	+ Customer receiving and placing into storage

By concentrating on reducing RCT we can leverage performance in such a way that the “bottom line” will be greatly improved (Mason - Jones and Towill, 1999). Also, reliability and consistency of lead-time affects our relationship with the supplier and ultimately the customer since it affects the time of production and the delivery reliability of the company.
Transportation cost affects the price of the procured materials, transit time constitutes a significant part of the RCT affecting time, while its reliability affects the company's responsiveness.
Making, consists of all processes that the company develops in order to transform materials into finished products. In the case of internal transportation between distant assembly lines and warehouses transportation time and cost affects total production time and cost respectively.
Delivery comprises of all those processes that elapse between receiving an order from a customer until shipping it to his premises and invoicing him. Transportation is a part of this process affecting total delivery time and cost. Stewart (1995) identified two major metrics:

- delivery-to-request date: the percentage of orders that are fulfilled on or before the original customer requested date,
- delivery-to-commit date: is the percentage of orders that are fulfilled on or before the original schedule or committed date.

Accordingly, in returning, transportation affects the cost and speed of return activities.

3.4 Transportation and stakeholder satisfaction

3.4.1 Customer satisfaction

According to Kaplan and Norton (1996) customer satisfaction and loyalty are affected by three factors:

- product attributes in terms of quality, price, functionality
- customer relationships in terms of time, dependability, flexibility
- image and reputation

Quality, that is *"consistent conformance to customers expectations"* (Slack, 2007), is affected mostly by transit time especially in the case of time sensitive goods. Soosay and Chapman (2006) recognized several metrics under the term quality that include picking/dispatch accuracy, document/invoice accuracy, damage frequency, order entry accuracy, no of customer returns, no of credit claims, information accuracy, information availability.

Transportation cost is especially important in determining the method used to quote the firm's selling price and decide between different pricing method such as FOB – freight origin terms and delivered terms (Johnson et. al., 1999, Goldsby and Martichenko, 2005).

According to Stalk (1988) time is a source of competitive advantage. Melnyk and Denzler (1996) distinguished between six lead times that have to do with product design and engineering, procurement, production, delivery, order management and other times (i.e. time to respond to a claim). SCOR uses the measure "order fulfillment time" to include the above mentioned lead times (SCC, 2006). The aim for every company is not to reduce lead times in general but to eliminate those that do not add value. This effort towards "time compression" that was initially mentioned by New (1992) does not necessarily means speeding up but according to the type of the organization and the type of the product focuses on those operations that only add value to the company (Waters, 2003). Transportation is a value adding operation since it is the connective point between production and consumption. Transit time reduction adds value for the companies that need small order fulfillment lead times but is not always a necessity compared with the associated cost of speed mainly in the cases of easily anticipated demand which means earlier planning and low value products (Harrison και Hoek, 2007).

Dependability, means avoiding variations from the purpose (Schonberger and Knod, 1997). Slack (2007) focuses on delivery dependability that is keeping the delivery promises as a major goal of business operations. It is a measure of conformance not with specifications but with time and is calculated as the difference between agreed and actual delivery date (Slack et al, 2007).

Delivery dependability ensures the fulfillment of the perfect order where the correct customer will receive the correct product, at the correct place, at the correct time, in the correct condition and packaging, in the correct quantity associated with the correct documentation (SCC, 2006). Transit time and its consistency and reliability are primary factors that determine delivery dependability and supply chain reliability. Furthermore, keeping reliable transit times translates also into keeping low safety stocks and inventory levels (Slack, 1999).

Flexibility reflects the ability of organizations to change and exploit opportunities stemming from changes in their environment that stem from new customer needs and wants (Dreyer and Gronhaug, 2004). Companies can react by increasing internal flexibility (focus on their operations) and/or external flexibility (focus on their

customers). Transportation cost and time mainly affects external logistics flexibility, that is the ability of a company to change the place and time of its products delivery (Slack et al. 2007).
Transportation can also affect the image and reputation of a company to a great degree especially in the case of companies selling time-sensitive products or trying to differentiate focusing on specific transport strategies that include transportation quality in terms of speed, frequency, reliability, safety, flexibility, environmental consideration, energy consumption etc (Konings et al., 2008). In such cases an unanticipated increase in transit times will destroy their competitive advantage and reputation. The same stands for companies following low cost strategies in the case of increases in transportation costs.

3.4.2 Supplier satisfaction

Supplier Relationship Management (SRM) defines how a company interacts with its suppliers with a desired outcome of a win-win relationship (Lambert and Knemeyer, 2007). Gunaskaran et al (2001) after conducting a literature survey concluded that the parameters that measure the level of partnership between buyer-vendor in a supply chain include information sharing, cost saving initiatives, mutual co-operation aiming at improving quality, supplier involvement, mutual assistance in problem solving efforts. Neely et al (2002) point out that the desirable supplier must be fast, right, cheap and easy to do business with. At the same time the supplier request reasonable profit margins, growth in sales volumes over time, feedback on performance and suggestions as to ways of improving and access to key information in order to aid supply chain efficiencies and to establish longer-term collaborative ventures. Transportation affects SRM in terms of cost, speed and dependability while allows for the development of new partnerships with long distance suppliers while variabilities in transit time may call for the examination of new vendors.

3.4.3 Regulators and Community Satisfaction

International, national, local and industry-specific regulators as well as pressure groups want companies to comply with the existing laws, be fair, safe and true in saying what they and their products really do. Communities want employment for their people, integrity and contribution towards making their community a healthy and prosperous one (Neely, 2007).
Major area of concern for both regulators and the community include the employment conditions in transport means, the impact of transportation in environmental sustainability, energy consumption ans safety. Sambracos (2001, 2008) provides an overview of the main characteristics of transportation as a public good with several externalities and certain regulations that stand for the EU operating countries.

3.4.4 Investors satisfaction – financial performance

According to Kaplan and Norton (1996) improved quality, responsiveness, flexibility etc. are means to an end and not the end itself. Such improvements will benefit a company only when the can be translated into revenue growth, cost reduction and and better asset utilisation.

SCOR distinguishes between cost of goods sold and supply chain management cost. Cost of goods sold or cost to make is the cost of associated with buying raw materials and producing finished goods (SCC,2006):

Cost of goods sold = direct costs (labor, materials) + indirect costs of making
and

Total Supply Chain Management Cost = Cost to plan
+ cost to source
+ cost to make (cost of goods sold)
+ cost to deliver
+ cost to return .

Transportation cost is a portion of total supply chain management cost as well as the cost of goods sold (when included in the cost of raw materials) affecting Return on Supply Chain Fixed Assets, Return on Working Capital and Return on Investment respectively. In order to estimate its impact on cost though we need to bear in mind the existence of various trade offs between transportation cost and other costs, especially the cost of holding inventory (Lambert et al., 1998). These two cost categories account for the 90% of total logistics costs according to the 19th Annual State of Logistic Reports for the year 2007 (Council of Supply Chain Management Professionals, 2008). Transportation costs accounted for 61% of total logistics costs followed inventory carrying costs (taxes, obsolescence, depreciation, insurance, interest – 27%), warehousing (8%) and administrative and shipper related costs (4%) with trucks accounting for almost 80% of total transportation cost.
Reducing the cost of goods sold translates into lower prices and therefore increased sales. Sales are also enhanced by improvements in other transportation attributes such as transit times and dependability that affect customer satisfaction.
In the area of asset management Cash to Cash cycle is a measure of efficiency of the working capital that represents the time required for a company to convert cash payments to suppliers of inputs to cash receipts from customers (Stewart 1995, Kaplan and Norton, 1996):

Cash to Cash cycle time = inventory days of supply + days sales outstanding
- days payable outstanding

Inventory days of supply is a ratio of inventories to cost of goods sold and estimates the number of days “demand” that a given amount of inventory could cover. Examining the inventory days-of-supply at the raw material and finished goods levels is critical for understanding the sources of a performance advantage in this area (Stewart, 1995). Reducing transit time and keeping it consistent leads to a reduction in the inventory days of supply ratio and the cash to cash cycle time and an increase in its reliability (Harrison and Hoek, 2007).

3.5 Putting it all together – the big picture

In the previous paragraphs, we discussed how specific transport changes in terms of cost, time and time consistency can affect performance metrics and propagate to overall financial performance based on a generic framework. We are now putting it all together in order to develop our framework for assessing the role of transport on

organizational performance (figure 2). We use cause and effect links in order to map the relationships that start with an exogenous transportation change and lead to financial performance, that is the ultimate goal of every organization. The distinctions we use between processes do not indicated an internally fragmented organization but are only used for simplification reasons in order to reduce the complexity of the framework.

4. Conclusions and further research

In this paper we developed a theoretical generic framework showing how exogenous transport changes may affect performance of a typical organization producing and/or selling goods that uses transportation services regardless of its providers. We based our thinking on a systems perspective since transportation is part of a web of interrelated activities that cannot be treated in isolation. Our thinking was influenced by the numerous existing frameworks on performance measurement and proposed metrics but mostly we used BSC as a basis and SCOR five proposed business processes.

We consider this study as one of the first attempts to understand how transportation changes in terms of cost, transit time and dependability translates to performance. Based on it, the next step is to model and simulate our system (organization) structure in order to determine its behavior and the effects of transportation changes in a measurable way.

However, we recognize that this framework could be further altered in order to allow for more valid conclusions. For example if we removed the hypothesis of exogenous transport changes then we could see how changes in transportation would propagate to affect performance and return to affect these changes and create what Sterman (2000) describes as long term feedback. In any case we think that this framework could be used as a basis in order to study the impacts of transportation changes in a microeconomic way/

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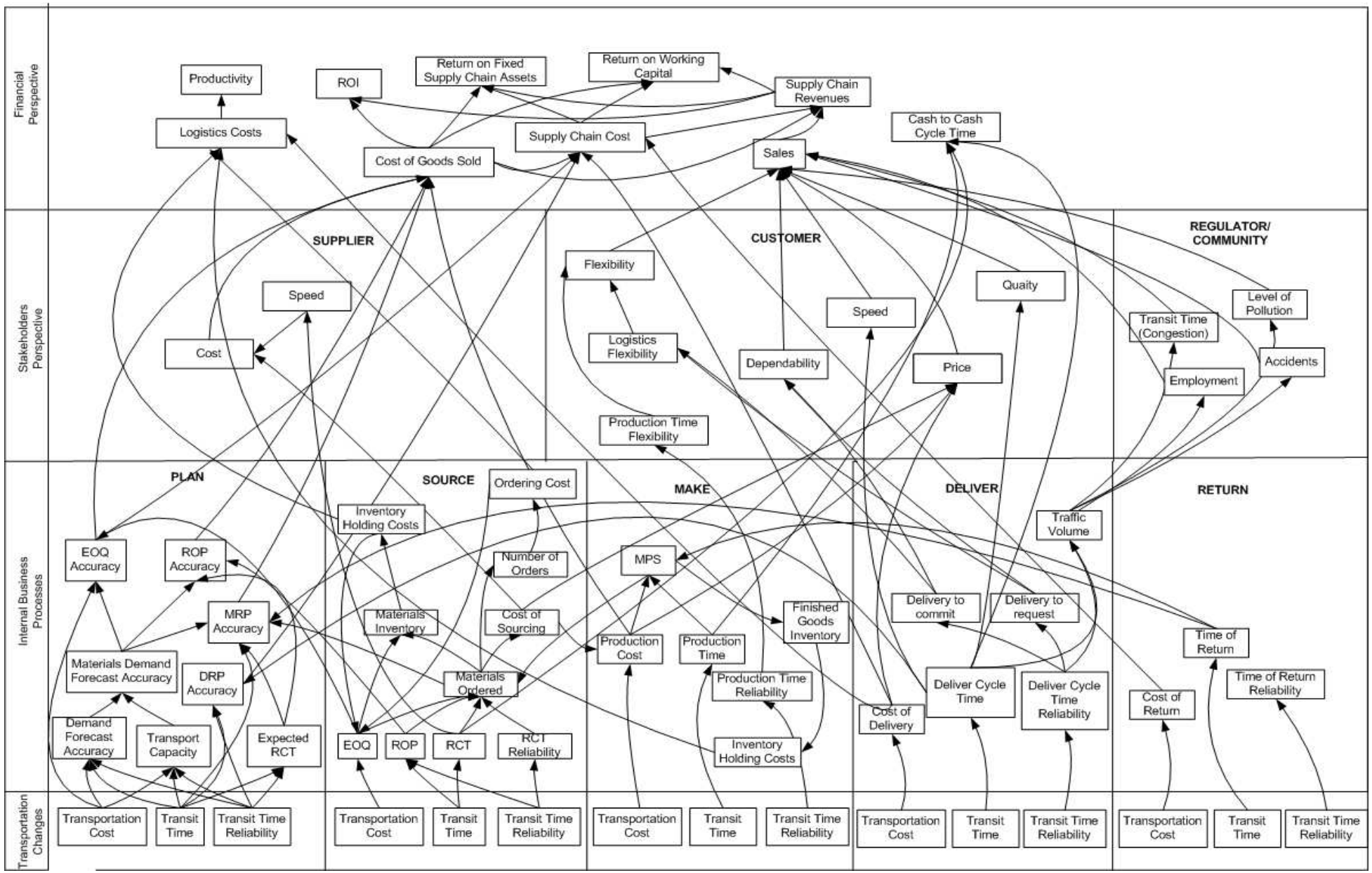

Figure 2: Structural Framework assessing the impact of transport changes on performance

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