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The Effect of IT Service Quality Attributes on Supply Chain Management and Performance

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Abstract**—**Nowadays, where most of the leading economies are service oriented and e-business is being widely used for their management, supply chain management has become one of the most studied and practiced fields. Quality has an important role on today's business processes, so it is important to understand the impact of IT service quality on the performance of supply chains. This paper will start by analyzing the Supply Chain Operations Reference (SCOR) model and each of its five activities: Plan, Source, Make, Delivery, and Return. This article proposes a framework for analyzing Effect of IT Service Quality on Supply Chain Performance. Using the proposed framework, hypotheses are framed for the direct effect of IT service quality on Supply Chain Performance and its indirect effect through effective Supply Chain Management. The framework will be validated empirically based on the surveys of executives of various organizations and statistical analyses of the data collected.

Keywords**—**IT service quality, SCOR model, Supply Chain Management, Supply Chain Performance

I. Introduction

THOUGH no definition of SCM is universally accepted, its characterization usually involves the idea of formally managing, across different companies, from raw material suppliers to final consumers, the entire set of activities necessary to produce value to the final consumer. Of course, this integrative management has the objective of making the chain's product more competitive, i.e. of lower cost, higher quality, more dependable, more diversified, and promptly delivered. The competitive model has changed from the conventional "business unit" to "virtual business unit." Competition is now focused on productive chains rather than on companies. The partnership has helped to decrease the inventory and to reduce costs [1]. This trend can be observed in manufacturing and in the competitive services as well. Mostly in the last two decades, a vast literature on Supply Chain Management (SCM) has been produced. Excluding sales services, much of the SCM literature addresses the case of manufacturing with little attention to services. There are some research studies about the interaction between SCM and IT and they vary between surveys [2], case studies [3], and even simulations [4]. Some research studies emphasize the need of IT implementation in order to share information through the supply chain [5]. There are very few studies that try to empirically link supply chain management practices such as quality assurance to supply chain performance.

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Some research studies have analyzed buyer–supplier cooperation and collaboration as performance variables. Some of the studies about the relationship between IT and the performance in the supply chain have supported this relationship [6], [7], while others have not [8].

It has been empirically established that IT service quality has been positively related to organizational performance [9]. However, there has been little research that associates IT service quality with supply chain management activities or supply chain performance. Further, previous research in supply chain management has combined the supply chain activity effectiveness and the resulting supply chain performance. In this research, we separate these two constructs to evaluate the effect of IT service quality separately on supply chain effectiveness and on supply chain performance using SCOR model. Consequently, the objectives of this article are i) to assess direct association between IT service quality and supply chain performance and ii) to assess the indirect effect of IT service quality on supply chain performance through supply chain management effectiveness.

II. Theoretical Background

A. SCM Conceptual Frameworks

Among the SCM conceptual frameworks proposed in the literature, the one by Lambert and Cooper [10] model (the Global Supply Chain Forum, hereafter L&C model) and the Supply Chain Council's Supply Chain Operations Reference (SCOR) model (www.supply-chain.org) merit special attention here because they address implementation issues and are based on empirical evidences, and involve business processes which could help to develop cross-functional integration management. L&C model is an academic model; it has a too broad view in its scope with more processes (eight in total). SCOR model is a practitioner model; with only five processes it is friendlier (with less challenges) to the companies implement it mainly if the companies are implementing SCM for the first time or want to start small and to implement SCM slowly. Because of the importance of practitioner orientation in academic research, we will use the SCOR model in this article.

B. Lambert and Cooper Model

Three basic elements compose the L&C model: the SCM Network Structure element (Who are the key SCM members with whom to link processes?), the SCM Business Process element (What processes should link each of these SCM members?), and the SCM Management component element (What level of integration and management should be applied for each process link?).

The SCM Network Structure element considers three primary aspects of the network: the members of the SCM, the structural dimensions of the network, and the different types of business process links across the SCM. The SCM Business Process element integrates the processes along the various companies that add value to the product from raw material to the delivered product.. It organizes and links a chain of managerial actions into business processes within and across the various chain member companies. L&C consider eight business processes: customer relationship management, customer service management, demand management, customer order fulfillment, manufacturing flow management, procurement, product development and commercialization, and returns. The SCM Management Component element has nine management components: planning and control of operations, work structure, organizational structure, product flow facility structure, information flow facility structure, management methods, power and leadership structure, risks and rewards, and culture and attitudes

C. The SCOR Model

The SCOR model allows firms to compare their performance on its metrics with the performance of other firms [11]. It was introduced by the Supply Chain Council (SCC), an independent, not-for-profit, global corporation, for improving quality performance and profitability. It is a cross-functional model. Like L&C, it helps to manage the supply chain activities and processes. It has five intra-organizational function and inter-organization process decision categories: Plan, Source, Make, Deliver, and Return (the return process was added later on to the SCOR model). Each of these processes is analyzed and implemented based on re-engineering, benchmarking, and best practice analysis concepts. It has four levels of process details moving from the scope and the content, to the specifications of the configuration of processes in line with operations strategies, to the details each process category into elements, and to finally the implementation. [12]--[14] have analyzed the interaction between SCOR and quality issues. Differently from the L&C model, the SCOR model dictates the activities that are connected basically with the product flow and it focuses on information sharing (intra-company interaction): it is intensively operations management driven and is not strongly aligned with the other functional strategies [15].

D.Service Quality

Service quality has been defined as the degree of discrepancy between customers' normative expectations for service and their perception of service performance. The service quality instrument developed in marketing, SERVQUAL [16], is a set of two questionnaires: one for service performance and the other for service expectation with five dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. Tangibles correspond to items that colligate to up-to-date facilities. Reliability reflects dependability and accuracy of the service team. Responsiveness is connected to the willingness of the service staff to provide prompt service. Assurance relates to knowledge of the staff and their ability to instill confidence in customers. Empathy is about the individual attention paid by the IS staff to the customers. As the definition of expectation is regarded to be too broad and ambiguous, the single expectation measure has been conceptualized as two levels of expectation [17]: desired service and adequate service. The desired service corresponds to a higher level of service a customer expects that can and should be delivered. Since customers do not receive their desired service levels, they hold another lower level of expectation, called adequate service. The adequate service corresponds to the minimum service level a customer accepts, which meets the basic needs of the customer (Fig. 1). A zone of tolerance (ZOT) is the range between the desired service and adequate service, within which a company's services will meet customer demands.

E. IT Service Quality

IS departments act as service units for various departments in the organization and organizational success depends on how well the IS services are delivered. Previous research has established the importance of IS service quality in the success of organizations [9]. The functional departments including operations, purchasing, sales, and distribution evaluate the performance of IS departments through the quality of services provided to them. In a survey of CIOs conducted by the Society for Information Management (SIM), "Improve IT quality" emerged as one of the top five concerns facing IT executives. Kettinger and Lee were the first to apply the SERVQUAL instrument to IS services, and to demonstrate its influence on IS user satisfaction. Pitt et al. have shown the importance of IS service quality in IS success models. In order to derive an IS-context specific instrument, Kettinger and Lee derived a 13-item IS-adapted SERVQUAL from the original SERVQUAL through specification search and refinement. IS-adapted SERVQUAL, which was derived with IS user satisfaction as a dependent variable, was found to possess better psychometric properties compared to the original SERVQUAL. Due to concerns similar to those with SERVQUAL, Kettinger and Lee [18] derived the IS ZOT instrument consisting of 18 items in four dimensions (reliability, responsiveness, rapport, and tangibles) based on Exploratory Factor Analysis. Tsai and Lu applied the ZOT concept incorporating fuzzy measures to the service quality of e-stores.

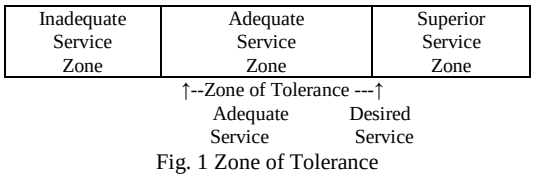

Fig. 1 Zone of Tolerance

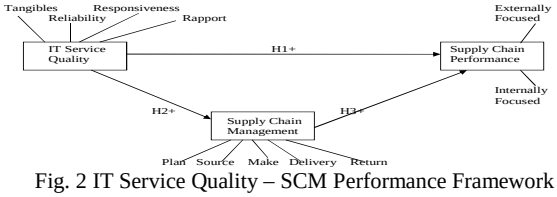

Fig. 2 IT Service Quality – SCM Performance Framework

III. Research Framework

Fig. 2 presents the IT Service Quality - SCM Performance framework, the proposed research framework. The framework connotes that IT service quality (with Tangibles, Reliability, Responsiveness, and Rapport) positively impacts supply chain performance that contains internally focused performance (revenue and profit driven) and externally focused performance (customer driven). IT service quality positively influences effectiveness of supply chain activities (Plan, Source, Make, Delivery, and Return), which in turn positively influences supply chain performance. We consider three types of IT service quality measures – perceived service (the level of service delivered by the service provider), service adequacy (the discrepancy between perceived service and adequate service expectation), and service superiority (the discrepancy between perceived service and desired service expectation).

IV. Research Hypotheses

A. Effect of IT service quality on Supply Chain Performance

Use of IT achieves operational efficiencies and effectiveness by lowering costs, reducing inventories, and minimizing stock-outs. Vijayasarathy [19] and Mukhopadhyay et al. [20] show the use of electronic data interchange (EDI) in supply chains helped Chrysler Corporation by at least $220 million by reduction of operating costs. These result in internally focused supply chain performance. The IT services can be better utilized with better service quality. If the IT services are provided on time and with better understanding of the business operations by the IT staff, these benefits are achievable. The primary use of SERVQUAL, as modified for IS service quality, has typically been related to the delivery of information services by IS departments [18]. IS services delivered on time and with error-free performance by the IS unit (i.e., reliability of IS service quality) will result in timely and efficient decision making, which +in turn leads to better internal organizational efficiency. By having knowledgeable IS specialists who maintain good communication through courteous interactions with business units, have users' best interests at heart and are able to understand users' needs better, IS services will become better aligned with organizational goals, resulting in improved quality of decision making and improved profitability, better anticipation of customer demands and more accurate sales forecasting. Furthermore, prompt provision of services to users in manufacturing, sales, and distribution departments by the IT unit will enable rapid responses to new business opportunities through market information support. Delivering quality service is a prerequisite for business success that leads to higher profitability, lower cost, higher revenues, long-term economic returns for the firm and increased repurchase intensions. IS staff, by providing prompt and reliable services to users and by understanding users' specific needs, can better anticipate and serve customer needs through appropriate product (goods and services) enhancements. IS specialists, by insisting on error-free records and providing dependable services, will ensure the continuity of successful business operations and profitability [9].

In the past, business disruptions due to inefficient IS operations have been reported by several sectors, such as the brokerage, credit card, and ATM sectors. Thus, IS service quality is positively related to internal and external organizational efficiency and success. IT-related resources (for example, human IT) serve as potential sources of competitive advantage, as per Resource-based View (RBV). Human IT resources include technical IT skills and managerial IT skills. According to RBV, IT specialists with these skills will be able to integrate IT and business processes more effectively, develop reliable and cost-effective applications, communicate well with business users, anticipate future business needs, and innovate with new product features. Furthermore, managerial IT skills help IT specialists to coordinate better with business units, resulting in successful systems. Accordingly, if a firm employs IT experts with IT / business skills and managerial IT skills, who are courteous with users and develop better relations with them and who are skillful in understanding users' specific needs, innovation can take place by adding new features to existing products or designing new products at low cost and/or by anticipating better customer needs. Due to e-commerce services, there are operational benefits to purchase operations, such as, shorter cycle time, reduced inventory, and the resulting increased profits [21]. Thus, we posit:

H1: Level of IT service quality (perceived service, service adequacy, or service superiority) is positively related to supply chain performance

B. Effect of IT service quality on Supply Chain Management

If the IT services are provided on time, the business users tend to perceive the help to be beneficial in their routine and decision-making tasks. Service quality is correlated highly with employee productivity improvement. Soteriou and Zenios show a strong correlation between the operating efficiency of a bank branch and superior service quality within that branch. Business users in planning, manufacturing, purchasing, and logistics gain satisfaction based on the superior services delivered to them by the IT department, which in turn leads to more use of the services and realization of the benefit, which consequently results in more efficiency and higher individual productivity improvement. Similarly, high quality services provided to user departments result in their improved productivity in operations, purchase, sales, or distribution departments because of useful IS outputs. During the implementation of an expert system, Gefen and Keil found that IS developer responsiveness to operational users' requests and to users' feedback regarding system functionality/bugs positively influenced perceived benefits of the system.

IT investments, through IS support, influence the areas of SCOR [22]. IT support through its role facilitates smooth communication and coordination of activities of SCOR, which in turn improves the efficiency and effectiveness of Plan, Source, Make, Delivery, and Return activities. IT services in supply chain management improves communication, thereby benefiting all parties along the supply chain through cooperation and information sharing. Through Internet

services, information is available regarding the activities of supply chain management, such as, what products are presently being manufactured, which products and orders are in the process of delivery, which products are being returned, and what are the trends of product prices? ERP systems, for example, will allow the information regarding manufacturing and through extranets will facilitate the external stake holders regarding the progress of the activities with reference to their orders and supplies [23]. The IT services play an important role in effective and efficient logistics management, user-friendly logistic services, and logistics management information [24]. Thus, we posit

H2: Level of IT service quality (perceived service, service adequacy, or service superiority) is positively related to supply chain management decision effectiveness.

C. Effect of Effective Supply Chain Management on Supply Chain Performance.

While supply chain financial performance is the key to business success, customer base is the key to financial performance. In today's customer driven market, a clear understanding of promoting high quality products, ensuring a reliable process and retaining existing customers are important [14]. The externally focused supply chain performance is achievable through better decisions through various SCOR activities. Through an empirical study, [13] found that effective decisions at the Make (joint production plans with suppliers, statistical quality controls, preventive maintenance schedules) and Plan (joint business plans, demand plans, joint material replenishment plan) decisions are positively related to internal business performance; further, they had shown empirically that effective decisions at Plan and Source (selection of suppliers, exchange of information on market trends, delivery promises) areas have positive impact on external business performance. Thus, we posit

H3: Management decision effectiveness is positively related to supply chain performance.

V. Research Methodology

Data have already been collected from industry from the employees who are involved in one or more activities of SCOR. Data will be analyzed through structured equation modeling using LISREL software, in which both the measurement model and structured models will be evaluated. Three models will be run using perceived service, service adequacy and service superiority. By the time of the conference, we plan to have the empirical results to be available to be presented.

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