

# Causal linkages between supply chain management practices and performance

## A balanced scorecard strategy map perspective

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### Abstract

**Purpose** – Today, supply chain design and management constitute a major source of competitive advantage for firms. The purpose of this paper is to empirically investigate, from a balanced scorecard strategy map (BSSM) perspective, the types of linkages through which supply chain management practices (SCMPs) impact on financial and non-financial performance, and consequently lead to the achievement of the firm's strategic objectives.

**Design/methodology/approach** – This study is carried out in two stages. First, based on the survey data collected from 450 French industrial firms (with a return rate of 20.2 per cent), structural equation modelling (SEM) is used to test eight hypotheses that are formulated through the discussion of previous theoretical and empirical findings in extant literature. Then, based on the framework of the BSSM, the SEM results are used to discuss the linkages between SCMPs and firm performance.

**Findings** – After confirming some of the relationships already observed in extant literature, the results show that there are many strategic paths (of different nature) that link SCMPs and other intangible assets to financial performance.

**Practical implications** – The results of the study constitute a practical contribution that would guide managers in the strategic alignment of their firm's supply chain initiatives with corporate strategy. The authors argue that when implementing supply chain management initiatives, managers should pay particular attention to how intangible assets act as mediating factors in the achievement of the firm's financial objectives. The BSC framework that the authors propose can also be used by researchers to investigate causal linkages between intangible and tangible assets.

**Originality/value** – There are few studies that adopt an extensive multidimensional approach by looking simultaneously at both upstream and downstream linkages of the supply chain whilst taking into account many performance measures. Using the BSSM framework, this paper proposes eight types of linkages that could lead to the achievement of the firm's strategic goals.

**Keywords** Partnership, Supply chain management, Information sharing, Customer orientation, Structural equation modelling, Balanced scorecard strategy map

**Paper type** Research paper



### Introduction

Thanks to a collaborative management of relationships between the organisations that constitute the value chain and to an integrated coordination of processes, from the ultimate supplier to the ultimate customer, supply chain management (SCM) aims to

create more value for customers, as well as for the supply chain partners (Mentzer *et al.*, 2001), thus improving performance not only within each organisation, but also across the whole chain. A SCM system entails the implementation of a set of practices that can be defined as activities deployed in an organisation in order to enhance the effective management of its supply chain (Li *et al.*, 2005). Despite the constantly growing attention given to research on SCM, contributions to the link between supply chain management practices (SCMPs) and performance are very diverse in scope and nature, and most often remain dispersed and incomplete (Li *et al.*, 2005). The existence of many SCMPs and many performance measures implies that both theoretical and empirical research can be focused on two fundamental questions:

- (1) Which SCMPs impact individually or collectively on which performance measures?
- (2) What is the nature of the linkages between the SCMPs and the performance measures?

The nature of the linkage could be on the one hand direct or indirect, and on the other hand, sequential, non-sequential, intra-dependent or reverse (based on the balanced scorecard (BSC) framework).

Regarding the first fundamental question, most studies often focus on only one or few aspects (or parts) of the supply chain such as the upstream network (Chen and Paulraj, 2004), the internal relationships (Williams *et al.*, 2013) or the downstream network (Tan *et al.*, 2002). There are just a few studies that adopt a global approach by looking simultaneously at both internal and external linkages of the supply chain (Li *et al.*, 2005). Moreover, most authors limit their study of performance to the use of partial or one-dimensional indicators, which are quite often financial (Vickery *et al.*, 2003). We can therefore say that in this field, two research streams can be distinguished: first, studies that aim to establish a link between two variables (a SCMP and a performance measure) based on a unique construct of SCM and performance, and most often by incorporating a mediating performance variable into the model (Li *et al.*, 2006). For example, Wong *et al.* (2013) looked at the effects of supply chain integration on product innovation, and Lotfi *et al.* (2013) proposed a conceptual model for studying the relationship between supply chain integration and product quality. Second, studies focusing on the impact of two or more SCMPs (considered separately or collectively) on one or several performance variables (Mohr and Spekman, 1994; Chen and Paulraj, 2004; Green *et al.*, 2007). More recently, Yu *et al.* (2013) investigated the effect of internal and external integration on customer satisfaction and financial performance.

Both in theory and practice, one thing is to study the number of SCMPs that are linked to one or many financial and non-financial performance measures, another thing is to understand the nature of these relationships. This is the second fundamental question. Some researchers have studied and confirmed direct linkages (Chen and Paulraj, 2004), some have reported both direct and indirect linkages (Vickery *et al.*, 2003; Kim, 2009) while some others have studied how parameters such as complexity (Gimenez *et al.*, 2012) or risk and environmental uncertainty (Srinivasan *et al.*, 2011) act as mediating factors between SCMPs and performance measures. Also, from the BSC perspective, linkages can be considered to be causal (sequentially or non-sequentially) or interdependent (Nørreklit, 2000). The notion of sequential and interdependent linkages will be defined later in the literature review section. Nørreklit (2000) and Oriot and Misiaszek (2004) argue that though most authors have claimed causal linkages

between the four perspectives of the BSC framework, the relationships between them are rather interdependent. In other words, they are not unidirectional.

Using the BSC framework, our study aims to simultaneously investigate the two fundamental questions discussed above, by adopting a multidimensional approach that looks at the impact of many SCMPs on many performance variables, with particular emphasis on the nature of the linkages. Through the discussion of the results of this study, these relationships can be linked to business strategy. Given that we did not find in the literature any paper that investigates the relationship between SCMPs and performance from a comprehensive multidimensional approach, we consider that our methodology constitutes an interesting contribution in this stream of research.

Mentzer *et al.* (2001) define SCM as “the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long term performance of the individual companies and the supply chain as a whole”. Based on this definition, SCM can be broken into two parts: internal (which entails cross-functional coordination and collaboration within the company) and external. External SCM can further be broken into two parts: upstream, which has to do with coordination and collaboration with suppliers, and downstream, which has to do with coordination and collaboration with customers. In the SCM literature, these three parts can be referred to as internal integration, supplier integration and customer integration (Flynn *et al.*, 2010; Wong *et al.*, 2013; Yu *et al.*, 2013) or supplier relationship management, internal SCM and customer relationship management (Dey and Cheffi, 2013). Given that the aim of this paper is not to review the numerous definitions of SCM in extant literature, it simply adopts that of Mentzer *et al.* (2001) since this contains the key elements (strategic coordination, collaboration across the whole supply chain and long-term performance) that we intend to study.

We have deliberately limited our study to three main SCMPs (information sharing, supplier partnership and customer orientation), for three reasons. First, they are perfectly in line with the definition of SCM that we adopted, with emphasis laid on inter-organisational coordination and close collaboration between the partners of the supply chain, value creation for the customer, communication and synchronisation of flows and the establishment of a long-term relationship. Second, they are broad in nature and cover almost all the facets (dimensions) of SCM that are found in the literature. And third, they are explicitly incorporated in the balanced scorecard strategy map (BSSM) model, which will constitute the basis of our research construct. The practice of information sharing is defined here as the willingness of a company to provide its partners with complete information that can be operational, tactical and/or strategic in nature (Li *et al.*, 2005). The quality of the information shared is essential to the development of the SCM system; it encompasses the relevance, credibility, accuracy and timeliness of the information (Anderson and Narus, 1990). Supplier partnership is defined as the establishment of a close and cooperative relationship with one’s suppliers. Commonly found in the demand chain management literature, customer relationship management could be defined as the development of a long-term relationship with customers through the deployment of measures aimed at improving the quality of the interaction between the company and its customers in order to better satisfy their needs and expectations (Li *et al.*, 2005).

As already mentioned, this paper proceeds in two steps: first, to establish and confirm, through a multidimensional approach, some of the relationships that have already been observed in extant literature between SCMPs and both financial and

non-financial performance; and second, based on the results of the first step and using a BSSM approach, to study the nature of the linkages in order to enable managers to comprehend how supply chain initiatives impact on performance and consequently on corporate strategic objectives. Based on a quick scan literature review, we will start by formulating our research hypotheses, as well as one postulate. Thereafter, we will present our methodology and the test of our research hypotheses using structural equation modelling (SEM). We will then present our results and discussion, before considering a conclusion.

### Literature review, hypotheses and postulate

In this section, we will carry out a quick scan literature review that will enable us to establish the links between SCM and performance before formalising them in the form of eight distinct research hypotheses.

#### *Link between sharing of information and performance*

Transaction cost theory provides a theoretical framework that is relevant to highlight the positive role of information exchange. In fact, an active and intensive communication between the partners of the value chain will tend to reduce informational asymmetry, thus limiting uncertainty and risks of opportunistic behaviour (Williamson, 1985). Moreover, if the information that is exchanged between the partners is complete, there is reduction in the risks of divergence of objectives, cheating or inappropriate assessment of the efforts made by each partner, and this reduces the costs related to performance measurement and the risks of misunderstanding and conflicts (Williamson, 1985). It follows that communication increases the benefits that the parties can derive from the relationship (Anderson and Narus, 1990).

Furthermore, sharing accurate, rich, appropriate and relevant information contributes to a better coordination of partners' actions, thus enabling them to easily achieve their goals (Anderson and Narus, 1990; Mohr and Spekman, 1994). By ensuring the synchronisation of the partners' operations, information exchange will lead to reduction in inventory levels and costs, and to generating more value for the customer (Lee *et al.*, 2000). Similarly, the intensity of information exchange enables to improve the responsiveness of organisations faced with rapidly changing markets and customer expectations (Narasimhan and Nair, 2004). The willingness of a company to systematically transmit information concerning decisions or changes in marketing (or production) plans, for example, enables one's partners to better plan and organise their own activities, thereby avoiding contingencies (Langfield-Smith and Greenwood, 1998). Information sharing therefore gives companies the opportunity to improve not only their efficiency but also their responsiveness and flexibility. As a result, the relationship between information sharing and firm performance has been studied and established by many authors recently including Agus (2011) and Ibrahim and Ogunyemi (2012). Based on this quick scan literature review, we can formulate the following hypotheses:

- H1a. The practice of sharing information with supply chain partners impacts positively on the organisation's non-financial performance.
- H1b. The practice of sharing information with supply chain partners impacts positively on the organisation's financial performance.
- H2a. The quality of information shared with supply chain partners impacts positively on the organisation's non-financial performance.

*H2b.* The quality of information shared with supply chain partners impacts positively on the organisation's financial performance.

*Link between supplier partnership and performance*

The postulate of resource-based theory is founded on the fact that the accumulation of resources, characterised by their value, their scarcity and their inimitability can constitute a competitive advantage, leading to a higher level of profitability (Wernerfelt, 1984). Consequently, it is then possible to consider that the specific links between the value chains of companies can lead to the development of capabilities (Srivasta *et al.*, 2001). Often referred to as intangible assets, these capabilities can be a source of competitive advantage (Ramsay, 2001). If we adopt the idea of competition based on capabilities, the source of competitive advantage lies not in the product itself but rather in the processes underlying its production. Also, success could result from the transformation of the key processes of the firm into strategic capabilities, which can create value for the customer. SCM therefore enables to generate capabilities that create value through the integration of processes, activities and functions across the value chain.

A supplier relationship management system, based on the use of a close relationship with a limited number of actors to jointly implement coordinated actions, enables to develop a core and unique competence that is difficult or impossible for competitors to imitate (Ramsay, 2001). This competence contributes more and more to the competitiveness of the firm in terms of cost, quality and responsiveness, in response to the ultimate customer's expectations (Koh *et al.*, 2007). Cooperative relationship with suppliers facilitates the understanding of the expectations of each party and enables to identify more easily and faster the potentials for process improvement, as well as the effectiveness of linkages between the value chain of firms (Lambert and Pohlen, 2001). Through early involvement and integration of suppliers in the design and development process, the company boosts its innovation capability and value creation for customers, thereby increasing its prospects for profitability (Wisner, 2003). Strategic partnering in a supply network is therefore considered to constitute a competitive advantage (Khaji and Shafaei, 2011). Moreover, the existence of a close relationship with a limited number of suppliers allows elimination of time wastage, concentration of efforts on value-creating activities and increase in product quality (Lambert and Pohlen, 2001). Based on this, we can formulate the following hypotheses:

*H3a.* Partnership-based practices of managing supplier relationship impact positively on the organisation's non-financial performance.

*H3b.* Partnership-based practices of managing supplier relationship impact positively on the organisation's financial performance.

*Link between customer relationship and performance*

Also from the perspective of resource-based theory, the existence of a close relationship with the customer can be considered a core competency of the firm and can constitute a source of sustainable competitive advantage. In fact, developing a relationship of intimacy with the customer seems to be relatively rare and difficult to replicate for competitors and is therefore likely to generate higher performance for the company and its shareholders (Srivasta *et al.*, 2001). Cultivating trust between the parties and their respective commitments, this type of relationship reduces the uncertainty attached to the transaction and improves the customer's loyalty, which in turn leads to higher profitability (Kumar and Shah, 2004). The intimacy developed with the customer

provides the organisation the opportunity to capture and analyse market responses to its products and/or services, thus enabling it to develop its capacity to adapt to changing expectations and even to better anticipate these possible changes (Kohli and Jaworski, 1990). In other words, collaborating and integrating with customers enhance firm performance (Yu *et al.*, 2013). Based on this, we formulate the following hypotheses:

- H4a.* The practice of customer relationship management impacts positively on the organisation's non-financial performance.
- H4b.* The practice of customer relationship management impacts positively on the organisation's financial performance.

#### *Nature of linkages between SCMPs and performance measures*

The definition of SCM by Mentzer *et al.* (2001) emphasises the strategic coordination of processes in order to create value for the organisation, as well as for its stakeholders. This implies that a firm's SCMPs should be aligned with its strategic goals. Though Kaplan and Norton's (2006) BSC and strategy maps provide a very good framework for achieving this alignment from a theoretical perspective, it is yet to be confirmed by empirical research (Nørreklit, 2000; Chareonsuk and Chansa-ngavej, 2010).

The four perspectives of the BSC are financial, customer, internal process, and learning and growth. One of the main strategic goals of a firm is to achieve profitable growth and this goal can be met by increasing financial performance. The customer perspective entails creating value for the customer and this can be achieved through customer satisfaction and higher quality of products and services. For a supply chain, improving internal processes can be achieved through various supply chain practices and initiatives (Kaplan and Norton, 2006):

- (1) developing and improving partnership with suppliers;
- (2) developing and improving relationship with customers;
- (3) improving organisational processes through collaborative information sharing and higher information quality;
- (4) improving delivery service through higher responsiveness and dependability;
- (5) improving products and services by developing innovation capabilities; and
- (6) reducing waste by controlling cost.

The learning and growth perspective includes how supply-chain-relation resources (human capital, information capital and organisational capital) are developed and managed. In this paper, we will be considering only how social performance is improved through employee satisfaction. Table I shows the strategic goals and scorecard performance measures (or capabilities) presented as a BSSM.

In the field of SCM, the BSC has been explored by many authors: Brewer and Speh (2000) and Bullinger *et al.* (2002) used it to analyse supply chain performance; Hult *et al.* (2008) looked at the link between supply chain orientation and BSC performance; Chang (2009) used it to evaluate SCM integration and Khaji and Shafaei (2011) used it to study strategic partnering in supply networks. Without using the BSC framework, Koh *et al.* (2007) studied the relationship between SCMPs and operational (and organisational) performance, but did not relate these relationships to the strategic goals of the firm. However, these studies have not successfully established the alignment of SCMPs with the strategic goals of the firm. It follows that the nature of the linkages

**Table I.**  
Balanced scorecard  
strategy map

	Strategy map	Scorecard performance measures/capabilities
Financial perspective	Achieve profitable growth	Financial performance
Customer perspective	Create value for customer	Customer satisfaction Quality of products and services
Internal processes	Develop and improve partnership with suppliers Develop and improve relationship with customers Improve organisational processes Improve delivery service Improve products and services Reduce wastes	Strong supplier partnership Close customer relationship Collaborative information sharing Information quality Responsiveness Delivery dependability Innovation capability Cost control
Learning and Growth	Improve human capital	Employee satisfaction

should first be understood before this strategic alignment can be empirically affirmed. This is why this paper aims to study the nature of the linkages between SCMPs and performance measures.

The first three levels (learning and growth, internal process and customer perspectives) of the BSC are generally considered to be intangible assets or non-financial performance measures while the fourth level (financial perspective) is regarded as tangible asset or financial performance measure (Kaplan and Norton, 1992). While some researchers try to lay emphasis on the causal (sequential or non-sequential) linkages between the BSC components, others (Nørreklit, 2000; Bryant *et al.*, 2004; Bento *et al.*, 2013) argue that these linkages are rather interdependent. A sequential causal linkage exists when one or more components of one BSC level have a cause-and-effect relationship with one or more components of the immediate level in the upward direction (e.g. a causal upward relationship between the learning and growth perspective and the internal process perspective or between the internal process perspective and the customer perspective). A non-sequential causal linkage exists when one or more components of one BSC level have a cause-and-effect relationship with one or more components of any level beyond the immediate level in the upward direction (e.g. a cause-and-effect relationship between the learning and growth perspective and the customer or the financial perspective). We note that sequential and non-sequential causal linkages are unidirectional and upward; this is why their existence will culminate in the achievement of the financial objectives (Bryant *et al.*, 2004). An interdependent linkage exists when the relationship between the components of two BSC levels (whether or not they are adjacent) are in any of the two (upward and downward) directions. In order to clearly distinguish between the upward interdependent linkage and the sequential (or non-sequential) linkage, we will for the purpose of this paper use the terminology “reverse linkage” to denote the downward linkage between the components of any two BSC levels, whether or not they are adjacent. To complete this spectrum of relationships, we will use the terminology “intra-dependency” to denote the linkage between any two components within the same BSC level (perspective). By combining these four types of linkages with the notion of direct and indirect impact, we obtain eight possible types of linkages:

- (1) direct sequential linkage (DSL);
- (2) indirect sequential linkage (ISL);

- (3) direct non-sequential linkage (DNSL);
- (4) indirect non-sequential (INSL);
- (5) direct intra-dependent linkage (DIDL);
- (6) indirect intra-dependent linkage (IIDL);
- (7) direct reverse linkage (DRL); and
- (8) indirect reverse linkage (IRL).

These eight types of linkages are clearly defined in Table II. Based on the results of our SEM, this paper aims to investigate how the relationships between SCMPs and financial and non-financial performance measures fit into these eight types of linkages.

A strategy is a set of hypotheses about cause and effect (Kaplan and Norton, 1996). The BSSM provides a framework that enables to link together the four BSC perspectives by cause-and-effect relationships. With reference to Kaplan and Norton (1996), Bryant *et al.* (2004) noted that although the BSC is designed to translate the firm's strategy and mission into measures that managers can use to manage the organisation, BSCs contain both generic measures (such as return on investment, customer satisfaction, customer loyalty, market share and new product introduction) that are common across organisation and unique measures that are tailored to the firm's competitive strategy. Bryant *et al.* (2004) also observed that a significant stream of literature provides evidence that even when managers collect and track unique measures, they still place primary reliance on traditional generic measures. We can therefore argue that if a significant majority of linkages between the generic components of the various BSC levels are sequential or non-sequential in nature

	Direct	Indirect
Sequential	<i>DSL</i> Linkages where a component of one BSC level has a direct upward cause-and-effect relationship with a component of the immediate level	<i>ISL</i> Linkages where a component of one BSC level has an upward causal relationship with a component of the immediate level, but via another component at any level
Non-sequential	<i>DNSL</i> Linkages where a component of one BSC level has a direct upward cause-and-effect relationship with a component of any other level beyond the immediate level	<i>INSL</i> Linkages where a component of one BSC level has an upward cause-and-effect relationship with a component of any other level beyond the immediate level, but via another component at any level
Intra-dependent	<i>DIDL</i> Linkages where there is a causal relationship between components within the same BSC level	<i>IIDL</i> Linkages where there is a causal relationship between components within the same BSC level, but via another component
Reverse	<i>DRL</i> Linkages where there is a downward cause-and-effect relationship between the components of two BSC levels, whether or not they are adjacent	<i>IRL</i> Linkages where there is a downward cause-and-effect relationship between the components of two BSC levels, whether or not they are adjacent, but via another component at any level

**Table II.**  
Types of linkages  
in a balanced  
scorecard



(whether they are direct or indirect), then the BSC perspectives have a cause-and-effect relationship that would culminate in the achievement of the firm's strategic (financial and non-financial) objectives, especially when the components of the BSC perspectives were formulated based on the firm's vision and mission statements. In the case of SCM, we can formulate the following postulate:

When using the balanced scorecard as a framework for strategic alignment, if there is a significant number of sequential, non-sequential, intra-dependent and reverse causal linkages (whether they are direct or indirect) in the relationships between supply chain management practices (SCMPs), non-financial performance measures and financial performance measures, then these SCMPs will most likely impact positively on the firm's strategic goals.

As discussed previously in this section, many authors have studied the impact of SCMPs on performance, but to our knowledge, none has empirically investigated the alignment with the firm's strategy based on the nature of the linkages between the BSC components. In this regard, we consider that this constitutes an interesting and original contribution of this paper.

### **Methodology**

#### *Unit of analysis and data collection*

This research was conducted on a population of 450 supply chain managers, logistics managers and purchasing managers of major industrial French firms. A convenience sample was established based on the directory of ASLOG (a French Association for Logistics). Each respondent was contacted by telephone in order to obtain their acceptance to participate in the survey and also to ensure that they possess the necessary skills and information (from a global supply chain perspective). Thereafter, electronic questionnaires were addressed to them. The 450 managers contacted enabled to validate and process 91 questionnaires. This represents a return rate of 20.2 per cent.

#### *Measures*

Within the framework of this study, we relied on previous measurements drawn from extant literature. All the variables in the model resulted in a multi-items measure, estimated on a seven-point bipolar scale. Besides, we tested the convergent validity, the discriminant validity and the reliability of the scales used. To do this, we first conducted an exploratory factorial analysis (principal component analysis (PCA)) on all the items constituting the variables involved in the analysis. This was followed by a confirmatory factorial analysis.

We first checked the relevance of the PCA using successively Bartlett's sphericity test and the Kaiser-Meyer-Olkin test, completed with measure of sampling adequacy. After a varimax rotation, we purified the scales. Finally, using the measure of Cronbach's  $\alpha$ , we looked at the reliability of factors resulting from the factorial analysis.

Then, we used the SEM (done with the software AMOS 18) to conduct a confirmatory factorial analysis. First, we checked the overall adjustment of the measurement model (by applying at the same time absolute adjustment indicators of the model:  $\chi^2/df$  (normed  $\chi^2$ ), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), standardised root mean squared residual (SRMR); comparison indicators: normed fit index (NFI), relative fit index (RFI) and a parsimony indicator of the model: consistent Akaike information criterion (CAIC)). Once the measurement model had stabilised, we were able to estimate the reliability, the convergent validity and the

discriminant validity of the constructs. To do this, we first applied Joreskog's  $\varphi$  – composite reliability, which, if greater than 0.7, allows to conclude that the scale is reliable – construct reliability (Bagozzi and Yi, 1988).

Then, we tested the convergent validity of the constructs by verifying three conditions: the level of significance of the *t*-test associated with each factorial contribution (critical ratio greater than 1.96), the square of the factorial contribution of each item greater than 0.5 (in order to make sure that each indicator shares more variance with its construct than with the measurement error associated with it) and the indicator of the average variance extracted or the  $\varphi$  of convergent validity greater than 0.5.

Finally, we tested the discriminant validity of the constructs by making sure that the  $\varphi$  of convergent validity of each construct was greater than the percentage of variance shared by the construct with the other constructs (correlation between constructs).

#### *Exogenous variables*

The measure of supplier partnership was derived from a combination of measures developed within the framework of vertical alliances through the contributions of Mohr and Spekman (1994) and scales developed within the specific framework of the SCM concept (Chen and Paulraj, 2004; Li *et al.*, 2005). The measure of the customer relationship management was developed on the basis of the conventional measures of this concept such as proposed by Kohli and Jaworski (1990), and on the basis of scales specifically tested within the framework of the SCM concept (Li *et al.*, 2005, 2006). For the information sharing variable, we adopted the measure developed by Li *et al.* (2005). The information quality variable was adapted from Li *et al.* (2005).

In the end, the measurement model comprising the explanatory variables presents a good adjustment both in terms of absolute indicators (NC = 1.423, GFI = 0.905, AGFI = 0.861, SRMR = 0.06) and of comparison indicators (NFI = 0.937, RFI = 0.885). Also, the parsimony indicators of the model (CAIC) present a value lower than that of the saturated model. Besides, all the constructs present values of Cronbach's  $\alpha$  greater than 0.8, as well as values of Joreskog's  $\varphi$  (reliability composite) also greater than 0.8. This allows us to conclude that the scales are very reliable. Furthermore, regarding the convergent validity of the scales, we observe that the *t*-test associated with each factorial contribution is significant, that the square of the factorial contribution of each item is greater than 0.5 and that the average extracted variance is greater than 0.5. Finally, the  $\varphi$  of the convergent validity of each construct being greater than the correlation of the construct with the others, we were able to conclude the discriminant validity of the scales.

#### *Performance variables*

Regarding performance measurement, we chose perceptual measures. On the one hand, the use of perceptual measures allows to overcome the reluctance of some respondents to provide objective data related to performance, especially financial (Zou *et al.*, 1998). Consequently, the use of such a measure enables to minimise the “no response” phenomenon and to improve the overall return rate (Zou *et al.*, 1998).

For the financial performance, we went for measures of profitability (commercial profitability, economic profitability and financial profitability). These measures of profitability are combined with indicators that track the evolution of the critical variables related to the competitive position or to the financial health of the company (traditionally used in this type of research): sales growth (Wisner, 2003), average profit

(Green *et al.*, 2007), improvement of cash flow or working capital (Wisner, 2003; Koh *et al.*, 2007). Following the exploratory factorial analysis, we purified this scale before collapsing it to only one comprehensive variable.

Regarding non-financial performance, we initially adapted the scales developed for four categories of variables. The first category is related to the creation of value for the customer (Kaplan and Norton, 1992; Vickery *et al.*, 2003; Li *et al.*, 2006; Green *et al.*, 2007). The second category concerns the innovative capacity of the company (Kaplan and Norton, 1992; Li *et al.*, 2005, 2006). The third category is related to cost control (Kaplan and Norton, 1992; Li *et al.*, 2005; Koh *et al.*, 2007). And, the fourth category is related to the performance of the company in terms of social responsibility (Kaplan and Norton, 1992), viewed from the perspective of employee satisfaction. Following the exploratory factorial analysis, our non-financial performance indicators were decomposed into seven categories: social performance, cost control, innovation capability, dependability, responsiveness, service and product quality and customer satisfaction (see the Appendix).

In the end, the combination of financial and non-financial indicators allows us to test the hypotheses on eight categories of performance measures by introducing the possibility of a mediating role of the non-financial performance measures between SCMPs and financial performance. To our knowledge, no similar study in extent literature has mobilised such a wide variety of performance variables.

#### *Control variables*

Several control variables that could affect the firm's performance were also taken into consideration in our study. We thus integrated into the research model four categories of variables in order to avoid any excessive interpretation in relation to the presence of these uncontrolled active factors and also to test their explanatory power. The first control variable is relative to the size of the company and is measured by the turnover. The second concerns the business sector and is integrated in the form of dummy variables, which assure that the company belongs to one of seven industrial sectors concerned by our study (machines and mechanical materials, electrical and electronic materials, automobile, aeronautical materials, rubber and plastic materials, computer hardware and other manufacturing industries). The third, which is also integrated in the form of a dummy variable, is relative to the function of the respondent. Finally, the fourth control variable considers the complexity of the supply chain, which is taken into account by the integration of two variables measured respectively by the number of customers and the number of products. For each of the seven models presented, we compared the quality of adjustment obtained with and without the integration of these control variables. In all the models, these control variables do not show any significant influence. Besides, their integration contributes to lowering the quality of adjustment of the models. This is why the models integrating the control variables are not presented.

#### *Hypothesis testing*

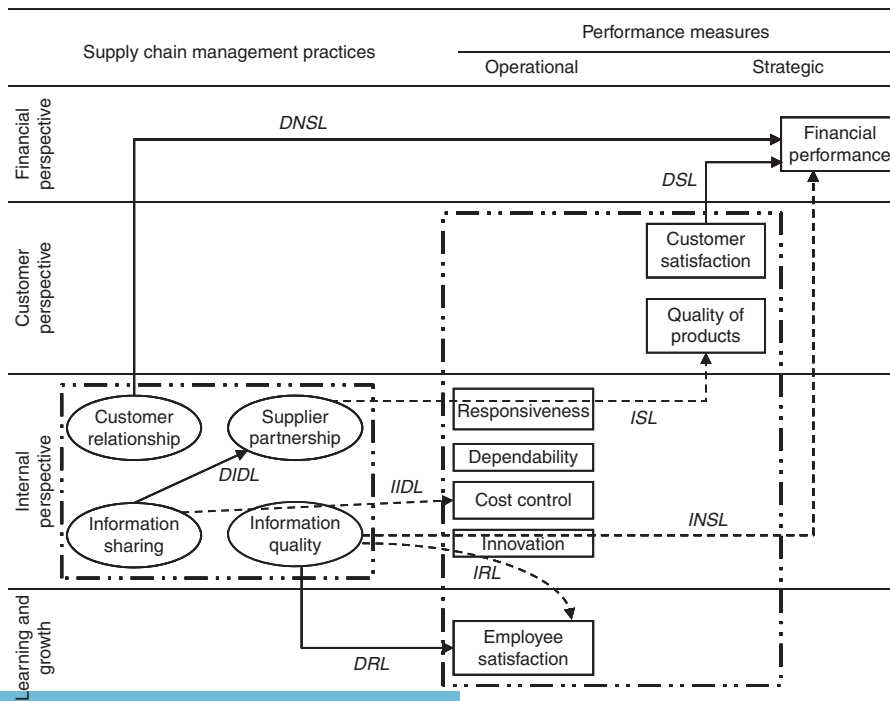
To test our research hypotheses, we used the AMOS 18 software that is based on the structural equation technique. Considering the good results of the measurement model, we used aggregated scores to measure the latent constructs, and this allowed to reduce the complexity of the model, as well as the specification problem.

Though our hypotheses have been formulated in a generic manner, we want to study independently the influence of each of the constitutive SCMP on each of the shortlisted

components of performance. Also, we intend to consider the possible mediating role of certain SCMPs in the relationship between SCMPs and performance, as well as the possible mediating role of the non-financial performance in the relationship between SCMPs and financial performance. In this perspective we tested, for each performance variable, the impact of the four explanatory variables identified in several successive models, including each time one of the seven non-financial performance variables and the financial performance variable. This enables to identify the direct and indirect effects of the SCMPs on financial and non-financial performance.

In order to develop a framework that will be used to validate the postulate that we formulated in the literature review section, we have grouped the BSC components (in Table I) into three categories (see Figure 1). Starting from the financial perspective at the top, we have the financial performance measure which constitutes a strategic objective. Then, we have the non-financial performance measures with customer satisfaction and quality of products constituting strategic objectives at the customer perspective level, while four non-financial measures (responsiveness, dependability, cost control and innovation) constitute operational objectives at the internal processes perspective level, and the last non-financial measure (employee satisfaction) constitute an operational objective at the learning and growth perspective level. Finally, information sharing, information quality, supplier partnership and customer orientation are the SCMPs at the internal process perspective level. Examples of the eight types of linkages are shown in Figure 1.

Figure 1 will be used to study how the inter- and intra-linkages between the components of the four BSC perspectives fit into the eight types of linkages.



**Figure 1.** Research construct showing causal linkages between balanced scorecard perspectives

As it is recommended in structural equations, we compared, for each performance variable considered, several alternative models in order to determine the model that would allow the best adjustment. For the sake of conciseness, we report only the models leading to the best adjustment.

### Results and discussions

We will first use the results of the SEM to discuss the direct and indirect impacts of SCMPs on performance measures. Then, we will discuss the nature of linkages by combining these direct and indirect impacts with the sequential, non-sequential and intra-dependent linkages in the BSC framework.

Our results show that SCMPs actually impact on the performance of the organisation to varying degrees, both directly and indirectly. All the models show a good adjustment from the point of view of absolute indicators (NC < 2, GFI > 0.95, AGFI > 0.945 and SRMR < 0.065 for all the models, and SRMR < 0.05 for five of the seven models presented), as well as from the point of view of comparison indicators (NFI > 0.9 for all the models, NFI > 0.95 for five of the seven models presented and RFI > 0.85 for six of the seven models presented). They also show a good adjustment from the point of view of parsimony indicators (the values of CAIC are systematically lower than the values of the saturated model). Table III summarises the direct and indirect effects of the SCMP on performance. The numerical value of the indirect impact is obtained by subtracting the direct impact value from the total value.

The primary objective in this paper is to investigate, using the BSSM framework, the linkages between SCMPs and performance measures (both financial and non-financial) which contribute to achieving the firm's performance objectives. But, we will first discuss the validation of our hypotheses individually before using the results of the SEM to discuss the paper's research objective, which will enable to validate the research postulate.

The seven models of our SEM (the results of which are presented in Figure 2) show not only the direct relationships between SCMPs and financial performance, but also the interplay between non-financial and financial measures. Employee satisfaction, cost control, innovation capability, delivery dependability, product quality and customer satisfaction impact on financial performance in models 1, 2, 3, 4, 6 and 7 respectively.

#### *Impact of information sharing on performance*

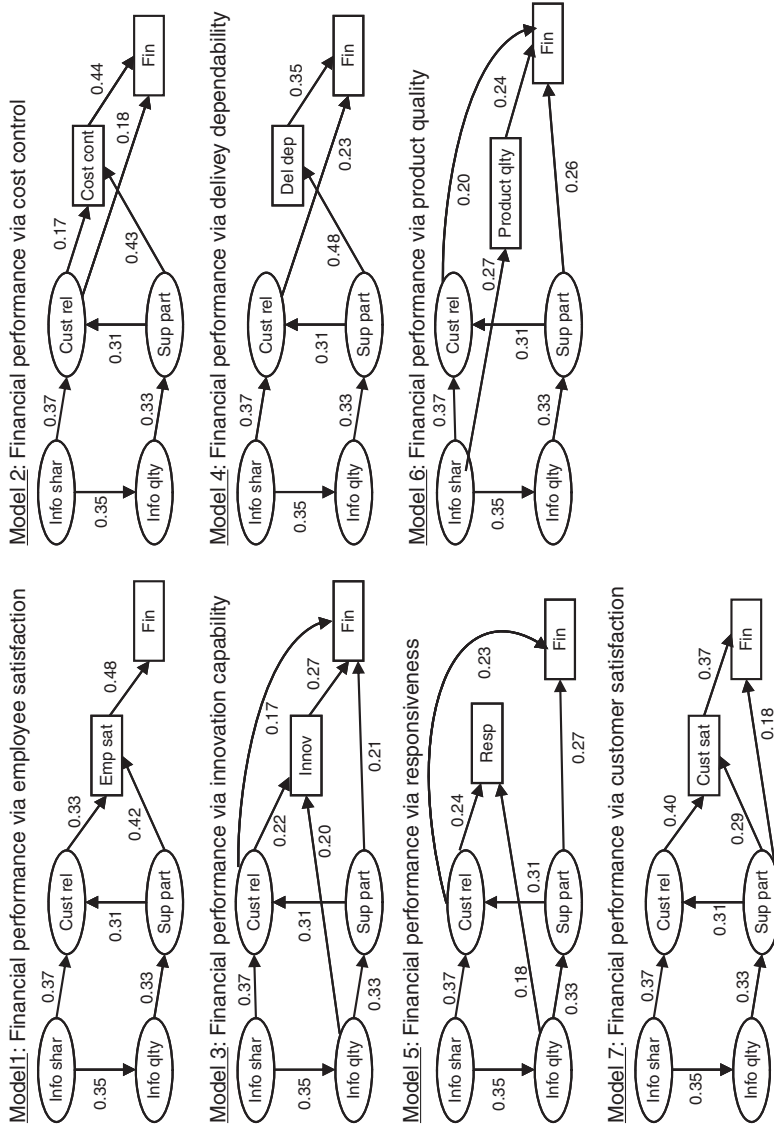
Regarding information sharing, our results show that it has a direct impact only on one non-financial performance measure (service and product quality) and none on financial performance. The indirect impact of this variable (information sharing) on the other non-financial performance measures, as well as on financial performance, could be explained by its influence on customer relationship. This indirect impact could be further explained by the fact that information sharing also acts on supplier partnership through its action on information quality. Based on this indirect impact on all the financial and non-financial performance measures (see Table III), we can claim the validation of *H1a* and *H1b*. Our results confirm and enrich the contributions of Mohr and Spekman (1994).

#### *Impact of information quality on performance*

In Table III we can see that information quality has a direct impact only on two non-financial performance measures (innovation capability and responsiveness) and

	Model 1 Employee satisfaction		Model 2 Cost control		Model 3 Innovation capability		Model 4 Delivery dependability		Model 5 Responsiveness		Model 6 Quality of products		Model 7 Customer satisfaction	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total
<i>Non-financial performance</i>														
H1a	0	0.18	0	0.12	0	0.16	0	0.05	0	0.16	0.27	0.27	0	0.21
H2a	0	0.17	0	0.16	0.20	0.22	0	0.16	0.18	0.20	0	0	0	0.15
H3a	0.41	0.52	0.43	0.49	0	0.07	0.48	0.48	0	0.07	0	0	0.33	0.46
H4a	0.33	0.33	0.17	0.17	0.22	0.22	0	0	0.24	0.24	0	0	0.42	0.42
<i>Financial performance</i>														
H1b	0	0.08	0	0.12	0	0.14	0	0.11	0	0.12	0	0.18	0	0.10
H2b	0	0.08	0	0.09	0	0.15	0	0.08	0	0.11	0	0.11	0	0.11
H3b	0	0.25	0	0.27	0.21	0.29	0	0.24	0.27	0.34	0.26	0.32	0.17	0.34
H4b	0	0.15	0.17	0.25	0.17	0.23	0.23	0.23	0.22	0.22	0.24	0.24	0	0.16

**Table III.**  
Standardised direct and total effects of SCMP on performance



**Figure 2.**  
Graphical  
representation  
of the results of our  
structural equation  
modelling

none on financial performance. Here again, the effects on the other non-financial performance measures and on all the financial performance measures are indirect. This indirect effect could be explained by its influence on supplier partnership. Given the direct and indirect impacts on almost all the non-financial performance measures, as well as the indirect impact on all the financial measures, we claim the validation of *H2a* and *H2b*. However, this hypothesis is not validated as regards the impact of information quality on service and product quality. Generally speaking, our results confirm and enrich the contribution of Mohr and Spekman (1994).

#### *Impact of supplier partnership on performance*

In four (models 1, 2, 4, 7) of the seven models presented, we observe a significant and strong direct positive impact on non-financial performance (employee satisfaction, cost control, delivery dependability and customer satisfaction (see Table III)). Besides, in two of the three models left, supplier partnership has an indirect impact on non-financial performance (innovation capability and responsiveness) through its action on customer relationship. In essence, it is only service and product quality that is not impacted by supplier partnership. Furthermore, in four (models 3, 5, 6 and 7) of the seven models presented, supplier partnership has a direct impact on financial performance. Also, in all the models presented, as well as through the non-financial performance measures in models 1, 2, 4 and 7, it impacts indirectly on financial performance through its influence on customer relationship. These observations lead to the validation of *H3a* and *H3b*.

Our results confirm the contribution of Chen and Paulraj (2004) who argue that the establishment of a long-term relationship with suppliers improves financial performance and the creation of value for the shareholder. They also confirm the contributions of Tracey and Tan (2001), who claim that supplier partnership impacts positively on delivery dependability, timeliness and customer satisfaction, the contributions of Li *et al.* (2006) who established the positive impact on responsiveness, as well as the contributions of Cetindamar and Ulusoy (2008) who observed that partnership between companies impacts on their innovation performance.

However, just as in the case of information quality, *H3a* is not validated as regards the impact of supplier partnership on service and product quality. This is not totally surprising since partnership with suppliers could entail collaboration in many diverse areas such as product development, joint planning, inventory management and lead time reduction. If some authors (Hoegl and Wagner, 2005) have reported the positive impact of supplier partnership on service and product quality in the first area (product development) where there is early involvement of the supplier in new product development, there is no evidence of its impact in the other areas mentioned above.

#### *Impact of customer relationship on performance*

In five (models 1, 2, 3, 5 and 7) of the seven models, as can be seen in Table III, we observe a significant and strong direct positive impact on five non-financial performance measures (employee satisfaction, cost control, innovation capability, responsiveness and customer satisfaction). Though we do not observe any direct or indirect effect on two non-financial performance measures (delivery dependability and service and product quality), we can nevertheless conclude that *H4a* is validated in almost all the cases. *H4b* is also validated since there is not only a direct impact on financial performance in five models (2, 3, 4, 5 and 6), but also an indirect impact in



four models (1, 2, 3 and 7) through its influence on non-financial performance measures (employee satisfaction, cost control, innovation capability and customer satisfaction). Our results not only confirm the contribution of Vickery *et al.* (2003), but also enrich it by extending the scope to a wider spectrum of non-financial performance measures.

We do not observe any direct or indirect impact of customer relationship on service and product quality. A possible explanation of the non-existence of an impact could come from the very broad definition of customer relationship as “an array of practices that are employed for the purpose of managing customer complaints, building long-term relations with customers, and improving customer satisfaction” (Li *et al.*, 2005). Therefore, if our respondents understood it as practices geared towards managing customer complaints, then its impact would rather be on responsiveness, as confirmed by our results. This is especially true given that responsiveness is defined as “the ability to minimize the time it takes to cater to customer needs by processing and solving their complaints [...]” (Vickery *et al.*, 2003). If however, our respondents looked at customer relationship as building long-term relations with customers, then a more appropriate terminology could be customer integration. In this case, Flynn *et al.* (2010) argue that it has an impact on product quality. We note also that the absence of a link could partly be due to the fact that after purification, we dropped the question that refers specifically to a follow-up feedback on quality of products and services, with the customers.

Also, our results do not show any direct or indirect impact of customer relationship on delivery dependability. In total disagreement with the contributions of Li *et al.* (2006) and Green *et al.* (2007), this result is more surprising given the fact that delivery dependability is a typical logistic performance measure. Once again, this divergence could have resulted from the various definitions used in formulating survey questions. For example, there are two dimensions to fulfilling a customer’s order: the ability to minimise the time between receipt and delivery of the order, and the ability to deliver on or before the promised due date. Vickery *et al.* (2003) referred to the former as delivery speed and to the latter as delivery dependability. While Li *et al.* (2005) kept only to the dependability dimension, we lumped together both speed and dependability.

#### *BSC linkages leading to the achievement of financial objectives*

Having validated the impact of SCMPs on both financial and non-financial performance, we will now use our proposed BSC linkage model (see Table II) to discuss the paths through which the eight types of linkages (derived from the results of the SEM and presented in Table IV) could lead to the achievement of the firm’s performance objectives. Given that in the BSSM framework, the financial perspective is the BSC level that leads directly to the achievement of the firm’s strategic goals, we will discuss the eight types of linkages with respect to the financial performance. With reference to the BSC framework, we will refer to the learning and growth perspective as level 1, the internal process perspective as level 2, the customer perspective as level 3 and the finance perspective as level 4.

First, based on our research construct in Figure 1 and the BSC linkages in Table IV, it can be seen that out of the two DSL and the six DNSL that lead to financial performance, two are at level 3 (customer satisfaction and product quality), five are at level 2 (two SCMPs – supplier partnership and customer relationship, and three operational non-financial performance measures – innovation capability, cost control

	Direct	Indirect
Sequential	<i>DSL</i> Info shar⇒Product qlty Sup part⇒Cust sat Cust rel⇒Cust sat Product qlty⇒Finance Cust sat⇒Finance	<i>ISL</i> Info shar⇒Cust rel⇒Cust sat Info shar⇒info qlty⇒Sup part⇒Cust sat Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Cust sat
Non-sequential	<i>DNSL</i> Empl sat⇒Finance Sup part⇒Finance Cust rel⇒Finance Cost control⇒Finance Innov⇒Finance Del dep⇒Finance	<i>INSL</i> Info shar⇒Product qlty⇒Finance Info shar⇒Cust rel⇒Finance Info shar⇒Cust rel⇒Cust sat⇒Finance Info shar⇒Cust rel⇒Innov⇒Finance Info shar⇒Cust rel⇒Cost control⇒Finance Info shar⇒Cust rel⇒Empl sat⇒Finance Info shar⇒Info qlty⇒Innov⇒Finance Info shar⇒Info qlty⇒Sup part⇒Finance Info shar⇒info qlty⇒Sup part⇒Cust sat⇒Finance Info shar⇒Info qlty⇒Sup part⇒Del dep⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cost control⇒Finance Info shar⇒Info qlty⇒Sup part⇒Empl sat⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Cust sat⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Innov⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Cost cont⇒Finance Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Empl sat⇒Finance
Intra- dependent	<i>DIDL</i> Info shar⇒Cust rel Info shar⇒Info qlty Info qlty⇒Sup part Info qlty⇒Innov Info qlty⇒Resp Sup part⇒Cust rel Sup part⇒Del dep Sup part⇒Cost control Cust rel⇒Cost control Cust rel⇒Innov Cust rel⇒Resp	<i>IIDL</i> Info shar⇒Cust rel⇒Innov Info shar⇒Cust rel⇒Resp Info shar⇒Info qlty⇒Innov Info shar⇒Info qlty⇒Resp Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Innov Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Resp
Reverse	<i>DRL</i> Sup part⇒Empl sat Cust rel⇒Empl sat	<i>IRL</i> Info shar⇒Cust rel⇒Empl sat Info shar⇒Info qlty⇒Sup part⇒Empl sat Info shar⇒Info qlty⇒Sup part⇒Cust rel⇒Empl sat

**Table IV.** Balanced scorecard causal linkages resulting from our structural equation modelling

and delivery dependability) and one is at level 1 (employee satisfaction). It follows that the financial objectives of a firm cannot be achieved only through sequential linkages as initially assumed by Kaplan and Norton (2006) and tested by Chareonsuk and Chansa-ngavej (2010), but also through non-sequential linkages as argued by other authors such as Nørreklit (2000) and Oriot and Misiaszek (2004) and tested by Bryant *et al.* (2004) and Bento *et al.* (2013). We observe that even though they did not use the

BSC framework, some other authors have reported results that are in line with our results. For example, Thornhill (2006) found a positive and significant relationship between innovation (a BSC level 2 component) and revenue growth especially in high technology firms. Extending this argument, we argue that high delivery dependability and product innovation will not only increase the loyalty of existing customers, but will also attract new customers, thereby leading to sales growth and eventually higher return on sales.

Second, the achievement of the firm's financial objectives (and consequently its strategic goals) is reinforced by the direct sequential impact of three BSC level 2 components (information sharing, supplier partnership and customer relationship) on two level 3 components (product quality and customer satisfaction), which in turn impact directly on financial performance.

Third, Table IV shows 17 INSL that lead to the achievement of financial performance. We note that sequential linkages are imbedded in most of these INSLs and this is in line with the initial assumption by Kaplan and Norton (2006) and as tested by Chareonsuk and Chansa-ngavej (2010). Also, all these INSLs start with information sharing and therefore deserve to be discussed. We had earlier mentioned that our two hypotheses on the impact of information sharing on performance (*H1a* and *H1b*) are only partially validated. The possible inexistence of a direct impact was implied by Ibrahim and Ogunyemi (2012), who having observed that supply chain linkages have more impact on performance than information sharing, noted that what matters is not what you know but rather what you do with that knowledge. We could deduce from this that the impact of information sharing will depend on the quality and use of the information shared. This could explain why 11 of the 17 INSLs lead to financial performance through the direct impact of information sharing on information quality. Five of the remaining six INSLs lead to financial performance through the direct impact of information sharing on customer relationship.

Fourth, the three ISL that are shown in Table IV lead to the achievement of only customer satisfaction through various SCMPs. But since customer satisfaction has a direct impact on financial performance, we can assume that these three ISLs would lead to financial performance.

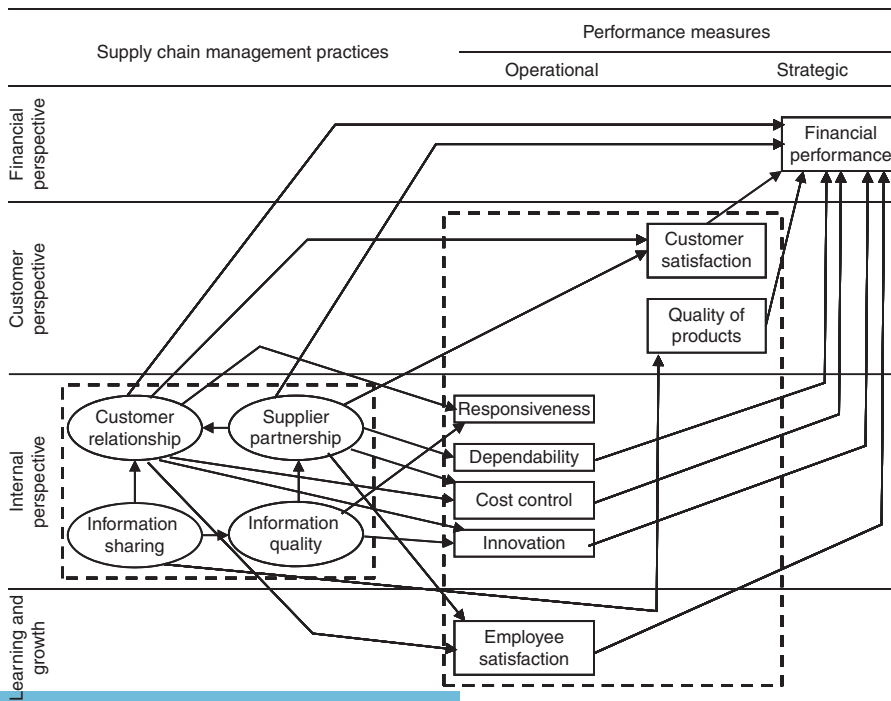
Fifth, in line with the argument developed by Nørreklit (2000), Oriot and Misiaszek (2004), Bryant *et al.* (2004) and Bento *et al.* (2013), that BSC linkages are rather interdependent than sequentially causal, Table IV shows many DIDLs and IIDLs. With the exception of five of them, which concern one and the same non-financial performance measure (responsibility), all the DIDLs and IIDLs can be assumed to lead to the achievement of financial performance since they are imbedded in the INSLs. Based on the two DIDLs and three IIDLs (concerning responsibility) that do not lead to financial performance, we argue that some SCMPs could impact on non-financial performance measures without ultimately leading to the achievement of the firm's financial objectives.

Finally, Table IV shows two DRLs and three IRLs. Based on Kaplan and Norton's (2006) initial assumption that the firm's financial objectives can only be achieved through upward sequential causal linkages, one would expect that a reverse linkage in the BSC framework would not lead to financial performance. However, given that employee satisfaction (a component of BSC level 1) has a direct non-sequential impact on financial performance, it can be argued that the two DRLs and three IRLs also lead to the achievement of the firm's financial performance. We note that the direct impact of a BSC level 1 component on a level 4 component has already been tested but not confirmed by Chareonsuk and Chansa-ngavej (2010).

Though interplays in a BSC framework between intangible assets (non-financial) and tangible assets (financial) have been investigated in extant literature (Bryant *et al.*, 2004; Chareonsuk and Chansa-ngavej, 2010; Bento *et al.*, 2013), this paper goes a step further to empirically demonstrate that financial performance can be achieved through many different types of linkages: direct sequential, direct non-sequential, indirect sequential, indirect non-sequential, direct intra-dependent, indirect intra-dependent and even reverse linkages. This can be considered a major contribution.

Figure 3 summarises all the paths that link learning and growth perspective and internal process perspective (SCMPs and some operational non-financial performance measures) to the customer and financial perspectives (customer satisfaction, product quality and financial performance), which constitute a firm's strategic objectives.

As discussed in the literature review section, BSCs contain both generic measures that are common across organisations and unique measures that are tailored to the firm's competitive strategy. Based on the observation that a signification stream of literature provides evidence that even when managers collect and track unique measures, they still place primary reliance on traditional generic measures (Bryant *et al.*, 2004), we can argue (by having a close look at Figure 3) that this paper has, at least from a theoretical standpoint, successfully demonstrated that the four BSC perspectives have a multitude of cause-and-effect linkages that would culminate in the achievement of the firm's strategic (financial and non-financial) objectives. This validates our postulate which states that when using the BSC as a framework for strategic alignment, SCMPs will most likely impact positively on the firm's strategic goals if there is a significant number of



**Figure 3.** Balanced scorecard strategy map causal linkages resulting from our SEM

sequential, non-sequential, intra-dependent and reverse causal linkages (whether they are direct or indirect) in the relationships between SCMPs, non-financial performance measures and financial performance measures.

### Conclusion

By adopting a multidimensional approach, this paper has succeeded in empirically confirming some of the relationships between SCMP and performance, which have been reported in extant literature in a dispersed manner. It also discussed some relationships which were not observed as expected (according to the findings of previous authors). In other words, it aimed to contribute to broadening the awareness of top managers looking for ways to improve the performance of their supply chains.

Going beyond the confirmation of some of the direct and indirect relationships that are already established by other authors, we have succeeded in using the BSSM approach to empirically demonstrate how SCMPs can be aligned with strategic objectives through a multitude of different types of linkages. This constitutes the major contribution of this paper. Our empirically built strategy map framework would enable operations and supply chain managers to constantly check the alignment of their SCM initiatives with the strategic goals of the company. Also, the BSC framework that we propose can be used by researchers to investigate causal linkages between intangible and tangible assets.

However, we acknowledge and admit the fact that the practical validation of this postulate will depend on the business characteristics of a firm. Based on the review of extant literature, Hsu *et al.* (2009) state that information exchange encompasses different types of information (supplier, customer, product, manufacturing procedure, transportation, inventory, sales and market, competition, supply chain processes and performance-related information). Therefore, performance outcomes would definitely be different depending on the type of information that is shared. For example, sharing sales and market information would improve responsiveness to customers, while sharing inventory and transportation information would primarily enable to reduce cost and would secondarily improve responsiveness. By conducting a simulation study, Schmidt (2009) showed how sharing aggregated order data contribute to reducing safety stocks and inventories levels. It follows that the impact of information sharing could be direct, indirect or inexistent depending on certain factors imbedded either in the value system or in its environment. Therefore, for the practical validation of our postulate, a case study research method might enable to have a detail description and investigation of a specific situation.

Putting aside the above comment on the research method that we used, this paper has naturally some limitations that constitute avenues for future research. The first limitation is related to the sample chosen to test our hypotheses. This was extracted from the database of ASLOG, which certainly enabled us to reach respondents who have some knowledge of the concepts that we discussed, but which however limits the external validity of our study and the possibility of extending the conclusions to all firms.

The second limitation has to do with the existence of other variables, which are not considered in this study, but which could influence the performance of the company and play a mediating role in the relation between SCMPs and performance. Also, we argue that the linkages between SCMPs and firm performance would depend on certain contextual variables such as business sector, market uncertainty, nature of products and services and the length of the supply chain, as well as on inter-organisational

variables such as cultural closeness, power imbalance, level of trust and divergence of strategic goals between supply chain partners. The inclusion of one or more of these variables as mediating factors will definitely constitute a basis for further research and would enable to develop BSSMs for different supply chain environments.

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Construits	Items
<i>Financial performance</i> Cronbach's $\alpha = 0.79$	<i>In comparison with your competitors, how would you rate your performance in the following areas (very weak/very strong)</i> Return on assets (ROA) Return on investment (ROI) Return on equity (ROE) Return on sales (ROS) Improvement on working capital <sup>a</sup> Average profit Sales growth <sup>a</sup> Cash flow improvement
<i>Non-financial performance</i> Dependability Cronbach's $\alpha = 0.81$ Responsiveness Cronbach's $\alpha = 0.89$ Quality of products and services Cronbach's $\alpha = 0.84$ Customer satisfaction Cronbach's $\alpha = 0.912$ Innovation capacity Cronbach's $\alpha = 0.7924$ Cost control Cronbach's $\alpha = 0.833$ Social responsibility performance Cronbach's $\alpha = 0.740$	Effectiveness in the production of products/services Timeliness Speed of delivery Speed of adjustment of resource capabilities <sup>a</sup> Speed of responding to changes in production volumes Speed of responding to changes in product mix Speed of responding to changes in product design Quality improvement <sup>a</sup> Failure rate Rate of product returns Product quality Quality of customer service Customer satisfaction Treatment of customer complaints <sup>a</sup> Development of new processes or technologies Development of new products or services Process improvement Cost reduction Productivity Employee engagement Motivation of employees <sup>a</sup> Personnel satisfaction Respect for environment <sup>a</sup>

**Note:** <sup>a</sup>The items were eliminated after the purification and scale procedure

**Table A1.**  
Summary of  
performance  
measurement  
variables

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