The Strategic Alignment of Supply Chain and IT Resources

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Abstract—**In reaction to recent findings, which suggest that when acting alone supply chain and IT resources cannot yield a competitive advantage to organizations, the present study, posits that it's by combining these resources together that organizations will gain a competitive advantage from them. Rooted in the resource-based-view and the relational view of the firm, this research presents a conceptual model that will permit the uncovering of the dominant configurations of supply chain and IT resources alignment. This study also presents three expected alignment configurations (i.e., cost driven organizations, value driven organizations and innovation driven organizations) which represent the primary form of alignment between these resources and their respective impact on organizational performance. Using the gestalt approach, we plan to verify our research model by collecting data from at least 200 Canadian prime manufacturers. Findings tied to this initiative will provide important contributions to both research and practice.**

Keywords- information management; supply chain resources; IT resources; alignment

I. INTRODUCTION

Organizations confronted with always increasing consumer demands [1] are now forced to realize tasks difficult to accomplish alone. Firms are thus relying more and more on their partners to successfully fulfill market demands [2]. This new dynamic is modifying the links bounding a firm to its partners [3] and brings the firm to outsource activities in which it is less competent [4]. Consequently, organizations are still relying on their own resources but also, and increasingly, on those accessed via their business relationships [5]. In turn, an important part of the competition among firms now occurs through their supply chain and not between individual organizations as it used to [6]. Another key factor of today's reality is that information technologies (IT) can provide competitive advantages to organizations [7]. This is particularly true in the context of a supply chain where information systems allow information to flow quickly and transparently across multiple interorganizational boundaries making it visible to all supply chain partners and in turn improving the performance of business relationships [7].

However, recent findings from IS studies question the value of these systems, arguing that they have become easily imitable necessities [8, 9]. As stated by the "resources based view of the firm (RBV)" [10] and the "relational view of the firm (RV)" [2], a firm's resources, whether housed by the firm or embedded in its relationship with its partners, cannot provide a competitive advantage if they are commonly available [11]. According to these theories, a firm will be able to obtain a sustainable competitive advantage over their competitors by combining its resources in unique and inimitable ways [12]. Furthermore, contingency theory stipulates that firm resources are ideally combined when the formers are aligned along their respective needs, demands, goals, objectives and structures. Such considerations bring managers to judiciously choose two types of key resources when establishing their business strategy: (1) those pertaining to their supply chain relationships [13] and (2) the IT resources supporting these relationships [14].

However, despite calls from several authors for firms to choose coordination mechanisms that best fit their supply chain relationship and capitalize on IT to improve their performance [15], little information is available in the literature for firms to address such alignment concerns. Indeed, even though the literature on information technology alignment at the organizational level is abundant [16], little is known at the interorganizational level. In fact, to the best of our knowledge, only four studies [17, 18, 19, 20] have attempted to investigate alignment at the interorganizational level and none of them have specifically focus on the alignment between supply chain and IT resources. It is crucial to study such alignment practices as information technologies are becoming more and more ubiquitous and easy to access due to the emergence of common communication protocol and web-based approaches. Therefore, information technologies are unlikely to provide competitive advantages by themselves and it is only trough their combination with other resources that organizations will derive benefits from them [8, 9]. Also, since competition in today's economy is now at the supply chain level it is essential to extend our knowledge on IT resource combination to the network level.

To partially address this gap in the literature, the following research aims to answer the following research question: According to the type of resources exchanged via their supply chain relationships, which information technologies will make it possible for companies to improve their performance and gain a competitive advantage? To do so, this study will develop a typology based on the dominant supply chain and IT resource alignment configurations.

The paper proceeds as follow: First, we present the literature on organizational resources (i.e., the RBV and its complement the RV). Second, we expose the underlying assumptions of the research after which the conceptual model and related propositions are presented. Third, our

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intended methodological actions are described. Finally, our anticipated contributions both theoretical and practical are discussed.

II. THEORETICAL DEVELOPMENT

A. Two Theories on Organizational Resources: the Resource Based View and the Relational View of the firm

Two theoretical perspectives that convincingly address the complementarities between supply chain and IT resources are the RBV and its complement the RV. According to the RBV, firms can be conceptualized as "resource bundles" [21] which may earn greater profits then their rival if they are able to identify and acquire resources that are crucial in the development of demanded product or services [2]. Barney[10], in his articulation of the RBV theory, formulates two fundamental assumptions: (1) that resources and capabilities are heterogeneously distributed among firms and (2) and are imperfectly mobile. Taken together, these assumptions allow for differences in firm resource endowments to both exist and persist over time, thereby allowing for a resource-based competitive advantage [10]. The RBV also posits that it is not all resources that can provide a sustainable competitive advantage. In order to play such a role resources must meet five criteria or possess five key characteristics [10, 22]. As explained by [22, p. 1087] "First, the resource must be valuable in that it improves firm efficiency and/or effectiveness. Second, the resource must be rare so that by exercising control over it, the firm can exploit it to the disadvantage of its competitors. Third, the resource must be imperfectly imitable to prevent competitors from being able to easily develop the resource in-house. Fourth, the resource must be imperfectly mobile to discourage the ex-post competition for the resource that would offset the advantages of maintaining control of the resource. Fifth and last, the resource must not be substitutable; otherwise, competitors would be able to identify different, but strategically equivalent, resources to be used for the same purpose"

In addition, it has been argued that even if a resource does not meet the RBV criteria when acting alone, organizations can still achieve sustainable competitive advantages by combining this resource to others [12]. To do so, organizations must combine resources in a way that is valuable to the firm, scarce, difficult to imitate and not substitutable [12]. Such combination has for effect to protect combined resources from competitive imitation by path dependencies, embeddedness, casual ambiguity about the source of competitive advantage, and time diseconomies of imitation [10] and thus making them a potent source of sustainable competitive advantage. Therefore, combining resources becomes particularly important when organizations rely on resources, which have relatively low barriers of imitation and acquisition [8].

Extending the RBV, the RV posits that an organization's critical resources not only include those housed within its limits but also those imbedded it their business relationships [23]. Similarly to housed resources, those exceeding firm boundaries must also meet resource-based-view's criteria to provide a sustained competitive advantage. Furthermore, firms can also choose to combine these resources if they do not meet these criteria alone [2]. Consequently, organizations can combine resources not only at the intra-firm level but also at the interorganizational level. More precisely, [2] argue that by developing partnerships ranging from transactional to collaborative partnering organizations can combine their respective resources to create synergies between them which in turn increase barriers to imitation and allow firms to benefit from sustained competitive advantages. Synergy creation mechanisms include: (1) information/knowledge exchange, (2) presence of complementary strategic and combination of organizational resources or capability, (3) investments in relation-specific asset, and (4) effective relational governance [2]. These mechanisms preserve sustained competitive advantages derived from these combined resources by increasing causal ambiguity, time compression diseconomies, interorganizational asset interconnectedness, and by the scarcity of potential partner, resource indivisibility, and institutional environments [24].

III. CONCEPTUAL FRAMEWORK

A. Underlying Assumption: The Need to Bundle Together Supply Chain and IT Resources

Despite the acknowledged importance of supply chain and IT resources, either housed or embedded in business relationships, for organizational success [25], recent studies show that each of these types of resources alone cannot yield sustained competitive advantages to organizations [22]. First, the supply chain literature indicates that supply chain relationships, and in turn the various resources associated with them, tend to provide only temporary competitive advantages to organizations since they are becoming more and more easily imitable due to technological evolutions which diminish transaction cost and encourage organizations to establish relationships with their external partners [22]. As such, organizations not only need to identify the critical resources embedded in its business relationship but also how to protect them from the mimetic behaviour of their competitor [22]. Insights from recent studies suggest that combining supply chain resources with other resources could be an adequate mean to alleviate their imitability [7, 24]. Indeed, findings from [24], in accordance to the premises of the RBV and RV, indicate that firms which invest in complementary resources to support supply chain resources can increase imitation barriers associated with them and in turn yield competitive advantages from what were at the start easy to imitate resources. Furthermore, findings from [7] also show that, by being combined with other organizational resources such as supply chain management information systems, the performance impact of relationship resources can be increased.

Second, research findings from the IS literature also indicate that IT resources may not meet the RBV criteria

when acting alone [26]. More precisely, these resources, as demonstrated by [8], present relatively low barriers to imitation and acquisition by other firms making IT-based advantages to diminish rather quickly over time [26]. Consequently, having recognised the limits of IT resources, authors from the IS field investigated various ways by which organizations could derive a sustainable competitive advantage from IT resources [26]. Following this endeavour, some authors have argued that one approach to palliate to IT resources shortcomings consist of judiciously combining them with other organizational resources [11] such as supply chain resources [7]. Indeed, by combining their IT resources with other organizational resources, firms could be able to insulate these resources from competitive imitation. Key findings from [11] corroborate this claim by indicating that the value of IT can be augmented only when it is embedded in an organization through resource complementarities and co-specialization.

Taken together, these streams of research argue that each type of resources would gain from an appropriate combination with other resources. Furthermore, organizations should seek to combine both types of resources together in order to minimize their respective shortcomings trough complementarities [26]. Indeed, the literature in supply chain management recognizes that information technologies represent a critical driver of supply chain success [27] while the IS literature recognizes that the full potential of IT resources can only be obtained through their adequate combination with other organization resources such as supply chain resources [7, 24, 26]. Hence, the main assumption of this research is that, to achieve a sustainable competitive advantage, organizations should align their supply chain and IT resources.

B. Research model:Uncovering the Dominant Configurations of Supply Chain and IT Resources Alignment

In accordance with our underlying assumption, Fig 1 exposes our research model, which will be used to uncover the dominant configurations of supply chain and IT resources alignment. The model comprises three facets (supply chain resources, IT resources and organizational performance.), which are detailed in the next sub-sections.

1) Supply chain resources:

From a RBV perspective, a supply chain relationship or supply chain linkage – defined as an "explicit and/or implicit connections that a firm creates with critical entities of its supply chain in order to manage the flow and/or quality of inputs from suppliers into the firm and of outputs from the firm to customers [22, p. 1084]" – can be seen as a resource per see or as a capability that allows a firm to acquire resources which in turn can yield benefits [22]. Although both viewpoints recognize the importance of supply chain linkage and are congruent with the RBV, they differ considerably on how and why they may provide sustainable competitive advantages to firms [22]. The former presumes that simply having a critical link with one supply chain partner guaranties some sort of abnormal rent while the later posits that even if an organization is linked to its partner, the firm still needs to exploit this relationship by acquiring or sharing resources with its partner to obtain a sustained competitive advantage.

As mentioned previously, firms are changing the nature of their relationship with their supplier; customers and other external partners forming new interorganizational coalitions, such as virtual enterprises and integrated supply chains [3]. Such changes stem from organizations' desire to move away from arms-length relationships to more collaborative partnerships [3] and harness benefits from closer and stronger partnerships [28]. In order words, organizations recognize that the simple fact of establishing a partnership (arm's length relationship) is not a guaranty for success, and that relationship should be viewed as a mean to efficiently manage forward flow of material and backward flow of information. The underlying aim of this observed organizational behaviour to encourage supply chain linkage forces us to consider supply chain relationships as capabilities, which allow organizations to acquire or share resources, and not as a resource per see.

Insights from case studies indicate that organizations, which establish supply chains relationships, do so in order to efficiently manage or acquire three different types of resources (1) materials, financial and information [7]. However, of these three resources, information and its effective management across supply chain partners is the one that exerts the greater impact on firm performance [7]. As such, the present research only focuses on this particular supply chain resource. Information sharing between supply chain partners has been examined by scholars from diverse background including, among others, information systems, operation management and marketing [24]. Following an extensive literature review on the subject, [29] concluded that information flows or information was a multi-dimensional resource encompassing three different sub-set of information: (1) operational, (2) tactical and (3) strategic each affecting organizational benefits differently and positively when shared efficiently and effectively [24]. Drawing from the work of [29], the present research adopts a three level classification framework for information and differentiates between operational, tactical and strategic information levels. More precisely, operational information refers to information tied to the production of product and services, such as information about resources conditions and plans such as inventory/capacity plans and production schedules [24]. When shared efficiently, this information allows partnering organizations to optimize input resources globally by streamlining buffers and synchronizing resource allocations [24]. As such, organizations sharing this type of information can achieve operational economies-of scale and reduce inventory and ordering cost [30].

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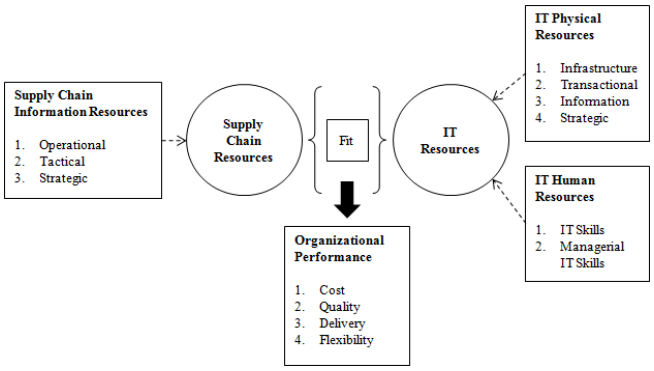

Figure 1. Poposed research model

Tactical information relates to financial metrics on margin structures and costs [24]. When shared adequately, this information enables parties to collaborate on ways to improve economic outcomes and to leverage both parties' resources [24]. As such, organizations sharing this type of information are usually able to improve their response to customer demands trough adequate delivery practices (i.e., continuous replenishment and quick response systems), making the flow of material in the supply chain to be "pull" by consumer demands rather than "pushed" by producers [30]. Finally, strategic information is defined as information that affects a firm competitive positioning and planned actions in the market [24]. When shared efficiently, this information allows business partners to obtain or increase their benefits by coordinating sales and marketing activities with operational requirements [24]. Therefore, allowing organizations sharing this type of information to move into new markets or develop new product [7].

2) IT Resources

Despite the fact that the RBV provides a helpful theoretical lens from which to assess the role of IT resources and their business value [31], the existing literature in the IS field is rather ambiguous on their definition and conceptualization [32]. For example, many different classification schemes have been proposed [9, 11, 31, 33, 34, 35]. From these proposed classification, two general conclusions can be drawn. First, IT resources are not monolithic and thus encompass different dimensions. Second each framework usually distinguishes between two types of complementary IT resources: physical IT resources and human IT resources, which are also consistent with Grant's classification scheme for resources [31, 33]. Both types of IT resources, physical and human, are considered essential and each complementarily enhances the success of a firm [32].

Physical resources usually refer to infrastructure and related deployment resources [31]. They are considered to be multi-dimensional and can include different types of IT investment: innovative vs. non-innovative, strategic vs. nonstrategic, and internally focused vs. externally focused investments [36] each reflecting a firm's strategy and affecting its performance accordingly [32]. The classification that most convincingly addresses this multi-faced role of IT physical resources is the one proposed by [32] which distinguishes between four different types of IT physical resources or IT investments: infrastructure, transactional, information, and strategic investments.

Infrastructure investments relate to shared IT services such as servers, networks, laptops, shared customer databases, help desk and application development used by multiple IT application. This type of IT resources provides the groundwork for present business initiatives as well as a flexible base for future business initiatives [32]. They require high up-front costs, which are in turn outbalanced by long-term performance improvements [32]. Transactional investments refer to investment made with the aim of automating repetitive business transactions and processes such as order processing, point of sale processing, bank cash withdrawal, billing statement production and other repetitive transactions [32]. As such, this type of investment is likely to cut organizational costs and/or increase the volume of business a firm can conduct per unit cost [32]. Information investment provides information to firm's managers communicating internally and externally with their supply chain partners. These investments can take the form of decision support systems that enable more effective decision making by allowing sale analysis and data mining. These types of investment influence a firm performance on the following indicator: control, reliability, delivery and adaptability of firms [32]. Strategic investment refers to IT resources which help repositioning the firm into the marketplace whether by supporting a firm's entry into new markets or by enabling the development of new products, services or business processes [32]. Consequently, these investments are likely to increase the flexibility of an organization in regards to customer demands.

Human IT resources, similar to physical resources, are multi-facet and are recognized to include technical and managerial IT skills [35]. Technical skills refer "to the know-how needed to build IT applications using the available technology and to operate them to make products or provide services" [9, p. 498]. These skills allow employees to be more productive which in turn decrease costs and improve other operational performance indicators [9, 35]. Furthermore, technical skills also enable firms to efficiently manage the technical risk associated with infrastructure investment [9], which in turn also diminish organizational costs. On the other hand, managerial skills refer to the "management's ability to conceive of, develop, and exploit IT applications to support and enhance other business functions" [9, p. 498]. These skills, compared to technical skills, relate more to employee's communication and analysis abilities. More precisely, they allow employees: (1) to better understand and appreciate the business needs of their counterparts, both internal and external, (2) to work with them in developing appropriate IT applications, (3) to coordinate IT activities in ways to support each other, and (4) to anticipate the future IT needs for all partners [9]. Consequently, managerial IT skills help organizations to reap

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the full potential of IT by increasing the adaptability of its employee, which in turn improve the flexibility of the organization and its level of customer service [9, 33].

3) Organizational performance

By establishing relationships with their trading partners, organizations aim to successfully answer final customers' demands [37]. Such demands from consumers are usually formulated along four evaluation criteria: price, quality, delivery and availability [1]. Accordingly, supply chain performance has usually been assessed along the corresponding criteria of cost, quality, delivery and flexibility [37, 38]. Cost relates to production cost, productivity, capacity utilization and inventory reduction while delivery criteria include: on-time delivery, short-time delivery, production lifecycle, lead-time and delivery on due date [39]. On the other hand, customers usually assess quality along eight dimensions: performance, features, reliability, conformance, durability, serviceability, aesthetic and perceived quality, from which the last two are inherently complex and the most difficult to measure [39]. Flexibility refers to a supply chain's agility, adaptability, and responsiveness to the needs of its users [40] and can be assessed along three dimensions: product mix, volume change over and modification [ward].

C. Research Propositions :Primary Forms of Supply Chain and IT Recources Alignment

In the context of this conceptual paper, we present, in this section, three expected alignment configurations that represent the simplest form of successful alignment between these resources to improve the various dimensions of organizational performance.

1) Configuration 1: Cost driven organizations

The first basic configuration proposed is anchored around operational information and its efficient management through its combination with key IT resources. As mentioned previously, operational information refers to information tied to the production of product and services and includes information about resources conditions and plans [24]. This type of information is, by nature, rather repetitive and requires limited interpretation, thereby making transactional investments a perfect match since they allow organization to automate repetitive business transaction [32]. However, other IT resources will also be needed as transactional investments also require infrastructure investments and technical IT skills to be efficient. Indeed, infrastructure investments provide the backbone from which every other IT investment is anchored [32] while technical IT skills allow users to efficiently use these transactional investments [9]. The combination of these four distinct resources is likely to yield a sustained competitive advantage to organization based on costs differentiation. Indeed, (1) sharing operational information allows economies-of scale, while reducing inventory and ordering costs [30], (2) transactional investments automate the sharing of operational information driving costs further down, (3) technical IT skills increase productivity which in turn also decrease costs [9, 35], and (4) infrastructure investments, when combined with technical IT skills which diminish implement costs, are also tied to cost reduction [32].

P1: When an organization mainly exchanges operational information with its supply chain partner and the operational information is combined with IT infrastructure investments, transactional investments and technical skills, the cost performance of the organization will improve.

2) Configuration 2: Value driven organizations

The second configuration presented here relates to the effective management of tactical information. Tactical information focuses on financial metrics, margin structures and costs [24]. This type of information is meant to help partners to collaborate and leverage their respective resources [24]. In turn, IT information investments are well suited to support the collaboration between partners by enabling internal and external communication between partners [24]. As such, we expect organizations to combine these two complementary resources together. Organizations relying on this combination will also need to add three other IT resources: infrastructure investments, technical skills and managerial skills. Again infrastructure investments are necessary to procure the adequate hardware required by information investments and technical skills will allow efficient use of these investments [9, 32]. Managerial IT skills are also essential since they represent communication and analysis abilities which are key when collaborating or when customizing decision support systems [9]. Taken together, tactical information, information investments, infrastructure investments, technical skills and managerial skills allow better decisions and in turn improve organization response to customer demands [30, 33] These improvements can take the form of demand driven supply chains or increase customer service [30, 33]. Thereby, the alignment of these resources should yield a sustained competitive advantage to organization based on quality and delivery differentiation.

P2: When an organization mainly exchanges tactical information with its supply chain partner and the tactical information is combined with infrastructure investment, information investment, technical IT skills and managerial IT skills, the quality and delivery performances of the organization will improve.

3) Configuration 3: Innovation driven organizations

The last configuration proposed focuses on strategic information sharing. Organizations share strategic information to position themselves in the market and coordinate related actions [24]. Such actions can take the form of new product development and entry into new markets [7]. Strategic investments also have the same

objective as they are destined to support similar actions [32] making them an ideal support to strategic information. As such, we expect organizations to match these resources together. This combination will also require three complementary IT resources: infrastructure investments, technical IT skills and managerial IT skills. Infrastructure investments and technical IT skills will play the same roles as previously described in configuration two. Managerial IT skills will permit managers to easily adapt to and anticipate future IT needs [9, 33] and thus enhance the value of organizational positioning actions. These resources, by being combined together, will allow organizations to anticipate and effectively reply to changes in customer demands by facilitating new product development and entry into new markets [9, 24, 32, 33], As such, we expect organizations pertaining to this configuration to gain a sustained competitive advantage based on flexibility differentiation.

P3: When an organization mainly exchanges strategic information with its supply chain partner and the strategic information is combined with infrastructure investment, strategic investment, technical IT skills and managerial IT skills, the flexibility performance of the organization will improve.

IV. RESEARCH METHODOLOGY

A. Data Collection

We plan on validating our research model with a stratified sample of 200 critical prime manufacturer-supplier relationships, where prime manufacturers are located in Canada and active in the four following industrial sectors: (1) machinery manufacturing, (2) computer and electronic product manufacturing, (3) electrical equipment, appliance and component manufacturing and (4) transportation equipment manufacturing. Top executive responsible of the supply chain activities of each manufacturer will be the selected respondent. For each respondent, we will collect information on a single buyer-supplier relationship, but the name of the chosen supplier need not be provided.

B. Reasearch Construct and Measures

Some constructs of the conceptual model have been previously used by researchers in the field of IS or supply chain (i.e., IT infrastructure resources [32], IT transactional resources [32], IT informational resources [32], IT strategic resources [32], cost performance [39, 40], quality performance [39, 40], delivery performance [39, 40] and flexibility performance [39, 40]) while others (i.e., operational information, tactical information, strategic information, IT skills, and Managerial IT skills) will be developed using [41] paradigm for measure development.

C. Satistical Analyses

For the purpose of this the study the gestalt perspective will be employed as it allows the uncovering of typologies (configurations) which is the major aims of this research. More precisely, this study will follow [17] six steps analytical process to find the configurations of supply chain resources and IT resources alignment. One-way analysis of mean (ANOVA) will also be used to identify the best performing configurations.

V. CONCLUSION

Rooted in the RBV and the RV, this research proposes a model that will permit the uncovering of supply chain and IT resources alignment configurations. Findings tied to this initiative will provide important contributions to both research and practice.

Alignment studies have traditionally been concerned with the extent of fit rather than the form of fit associated with IT resources. The present research significantly depart from these previous research endeavor and makes a significant contribution to research by being one of the few to investigate both the level and the form of alignment between supply chain and IT resources. Furthermore, contrary to most studies in the IS field, which have empirically assessed the role of IT resources at an aggregate level, this research proposes to empirically assess a set of physical and human IT resources. This will not only extend our understanding of IT resource alignment but will also increase our knowledge tied to organizational resources by revealing the distinct nature of IT resources and their respective role and impact.

From a methodological perspective, this research makes a significant contribution to research by validating a rigorous approach to cluster analysis, which extends our knowledge on alignment assessment and validation. This research will also develop important scales necessary to the measure supply chain and IT resources thereby making another important contribution to research.

From a practical viewpoint, this study will allow organizations to better manage their resources by identifying (1) their respective strengths and weaknesses, (2) their respective impact on various performance dimensions and (3) interaction effects that can entail sustainable competitive advantages.

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