

Luigi Cantone, Pierpaolo Testa, Giuseppe Fabio Cantone

Strategic Outsourcing, Innovation and Global Supply Chains

A Case Study from the Aviation Industry



Giappichelli

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Chapter 2

THEORIES OF THE FIRM AND IMPLICATIONS FOR OUTSOURCING

SUMMARY: 2.1. Introduction. – 2.2. Transaction Cost Economy Theory (TCET). – 2.3. Resource-Based Theory (RBT). – 2.4. Competence-Based Competition Theory (CBCT). – 2.5. Strategic Asset Theory (SAT). – 2.6. Dynamic Capability Theory (DTC). – 2.7. Knowledge-Based Theory (KBT). – 2.8. Open Innovation Theory (OIT). – 2.9. Network Theory (NT) and Supply-Chain Network Theory (SCNT).

2.1. Introduction

Innovation has always been one of the main forces driving the long-term competitive advantage and growth of firms. The effects it can produce in terms of creative destruction (Schumpeter, 1994) and the ability to profoundly redefine the rules of competition for firms and customers (Markides, 2000; Markides, 2008; Markides, 2015) are undoubtedly significant for even radically renewing ways of creating “value innovation” (Kim and Mauborgne, 2015). Innovativeness – a firm’s desire to build a competitive advantage by creating and introducing new products or services, adopting new technologies to enable fresh products or services – has been identified as one of the most critical capabilities a firm can possess (Eisenhardt and Martin, 2000). The meaning of ‘innovation’ assumed in this study concerns research and development activities, especially production, focusing on new product development (NPD). Product innovation is linked to process innovation when the manufacturing and designing processes trigger breakthrough product innovation in which the use of innovative materials may also be a contributing factor. Different perspectives in the literature have addressed the decision-making behind strategic outsourcing involving innovation (or R&D) activities, including the organisational and control mechanisms firms employ to increase the productivity of outsourced R&D activities and protect intellectual property (Carson, 2007), the strategic and economic logics underlying their choices (Quinn, 2000; Narula, 1999), the contractual models used to manage the decision (Grossman and Helpman, 2005, 2003, 2002; Hagedoorn and Hesen, 2007), the issues related to technology transfer among the firms involved in the outsourcing (Amesse, Dragoste, Nollet and Ponce, 2001), and networks of learning (Powell et al., 1996; Powell, 1998; Pisano, 1991; Hagedoorn, 1993, 1995, 2000; Hagedoorn and Schakenraad, 1994).

Until recently, firms generally preferred to carry out their innovation activities internally. Generally speaking, the reasons for this choice are as follows: 1. the strategic importance of innovation in long-term competitive advantage and growth; 2. the need to control core technologies and intellectual property to reduce the risk of losing the necessary competencies for innovation (Becker and Zirpoli, 2027) as far as possible and avoid knowledge and competence spill-over (Stanko and Olleros, 2013; Becerra et al., 2008); 3. the difficulties and high costs of coordinating the suppliers involved in innovation (Mikkola, 2003; Bertrand and Mol, 2013); 4. problems associated from sharing tacit knowledge, a critical factor in the collaborative relationships inherent in technological innovation (Mikkola, 2003; Bertrand and Mol, 2013; Martínez-Noya and García-Canal, 2016); 5. problems associated with arranging effective contracts and monitoring supplier performance.

Over the last few years, the management approach to innovation has begun to change. NPD activities are increasingly being outsourced because they make it possible to reduce the costs and risks (i.e., through risk-sharing contracts) associated with innovation projects, giving (tacit and explicit) access to new and complementary resources, competencies, and knowledge held by suppliers. Outsourcing also shortens the time-to-market of product innovation; in other words, outsourcing innovation activities is a practical strategic option for high-intensive innovation industries.

The following section explores the ways different theories of the firm explain the outsourcing of innovation.

2.2. Transaction Cost Economics Theory (TCET)

In accordance with the central tenets of Transaction Cost Economics Theory (TCET), outsourcing NPD activities is appropriate under two circumstances. The first occurs when the cumulative development, production, and transaction costs of innovation activities are lower than for those carried out within the firm. The second is when outsourcing innovation activities to external suppliers represents little risk (poor quality, delays in time-to-market, knowledge spill-over, opportunistic behaviour). Concerning knowledge appropriation risks (Nakamura and Odagiri, 2005; Steensma and Corley, 2000; Veugelers and Cassiman, 1999), the literature on property rights (Love and Roper, 2005; Gooroochurn and Hanley, 2007) sustains that outsourcing NPD may be possible when the risk of exclusive knowledge being expropriated by partners (opportunistic behaviour) is low.

TCET argues that a firm's main competitive goal is to minimise the overall production and transaction governance costs when there is little differentiation among its competitors' marketing offers. Companies, therefore,

seek to gain a cost advantage over their direct competitors. The choices relating to the vertical borders of a firm's value chain, and consequently its outsourcing choices, pursue this goal.

In TCET, initially proposed by Coase (1937) and Commons (1931, 1934), later developed by Williamson (1981), the decision whether to keep the value chain's activities internal or to outsource depends on three main transaction governance models, as follows.

The market solution relies on external firms for the value chain. These firms manage transactions through the market-price mechanism.

The hierarchy solution. In this case, hierarchical structure, routines, and organisational coordination mechanisms underpin the firm's transactions. Recourse to the "internal market" for transactions, vertically integrating the value chain's activities, gives a company autonomy in carrying out activities interconnected to its business (upstream or downstream vertical integration).

The hybrid or intermediate solution concerns the relationship between the hierarchy and the market. This organisational form of the transaction can be defined as neither hierarchy- nor market-related as it combines elements of both solutions. There are several kinds of interfirm collaboration relationships or hybrid governance structures. These include mid-to-long-term contract equity (joint ventures, consortium, minority shareholdings), non-equity-based contracts (licence, subcontracting, distribution agreements, know-how, and technology exchange), or strategic alliances. Governance of these relationships makes it possible to bring together the advantages of both solutions while limiting the disadvantages of adopting either of them singly (Williamson, 1981).

There is a direct relationship between "hierarchy" and keeping inside (or making), just as there is between outsourcing and "market" (or buy).

TCET suggests that a firm's value chain activities involved in outsourcing decision-making (making use of the market solution and market-price mechanism) are those where this kind of exchange governance reduces the total transaction and production costs compared with keeping decision-making internal (making use of internal resources and organisational coordination mechanisms).

As we said previously, from the TCET point of view, production costs are either internal (when keeping production inside or using the organisation as a transaction governance mechanism) or the market price (when outsourcing or using the market as a transaction governance mechanism). On the other hand, governance costs arise from defining, managing, and controlling any exchange relationship. Transaction costs usually arise from involving the market. However, they are still incurred when a firm keeps exchanges and transactions inside or internalises them (exploiting hierar-

chy). This is the case of costs relating to the design, organisation, and management of measurement systems for personnel performance (Arnold, 2000). The following activities entail transaction costs:

1. seeking, evaluating, and selecting supply partners;
2. negotiating and defining contract clauses;
3. monitoring supplier performance in accordance with contractual agreements;
4. reformulating contracts in order to consider new aspects/circumstances that could not be foreseen during the negotiation phase;
5. solving conflicts between buyers and suppliers;
6. moral hazard.

There are two kinds of transaction costs (Williamson, 1995; Sobrero, 1999): *ex ante* transaction costs, including those indicated as 1) and 2) above, and *ex post* transaction costs, indicated above as 3), 4), 5), and 6). Moral hazard costs are usually *ex post*. The actors involved in the transaction during the negotiation phase highlight future opportunistic behaviours (Vining and Globerman, 1999; Klein et al., 1978), and only transaction costs 1) and 2) can be established during the negotiation phase, before the outsourcing relationship takes place. The other costs arise as soon as the transaction becomes a reality. From this distinction in governance costs, it is evident that outsourcing the decision-making process cannot be based on perfect prior knowledge (“bounded rationality”) of the possible effects in terms of costs. In fact, these decisions are reached in conditions of bounded rationality, so it is essential to have an idea of the likely effects of these conditions on the key elements of the exchange relationship and the behaviour of the players involved. This means that, according to consolidated behavioural theory (Simon and March, 1963; Simon, 1975), the decision-making process is limited by individual and collective capabilities, the information and knowledge available, and socio-organisational and political factors, as well as by the motivational influence of the incentives (Chalos and Sung, 1998). Therefore, the decision-making processes, like those regarding the firm’s value chain boundaries, follow a pathway involving several phases. The more efficient and effective solution is an experimental approach incorporating iterative learning to reach the proposed – and adopted – solution. The learning processes occur when the exchange relationship takes place to evaluate whether the scheduled objectives are effectively met.

On the other hand, internal production costs come directly from the actual or opportunity costs of the resources needed to perform an activity. These costs are usually, and very precisely, calculated beforehand. Howev-

er, they may be higher than the market price for several reasons. TCET argues that any decision to outsource has to take into account the structure and interaction of the transaction and production costs. Therefore, outsourcing is not always the right choice when market prices are lower than production costs because the higher transaction costs might increase the spread [production cost-buying market price]. In TCET, the factors influencing transaction costs and, therefore, decisions concerning the governance of transactions, belong to two categories. These are “human factors”, i.e., the behaviours of the economic actors involved in the transaction, and the “environmental factors”, i.e., the nature of the transactions and the environmental context in which they occur. As for the behaviour of the economic agents and individuals in general, TCET argues, economic agents make decisions under conditions of bounded rationality because of their information and/or cognitive limits; decision-makers pursue their own interests, assuming opportunistic behaviours (false promises, pretence, even threats). Human factors, being innate to the behaviour of individuals, are not entirely influenced by the choices about transaction governance structure. The environmental factors are the following: the uncertainty within which the transaction takes place among the economic actors involved; the frequency of the transactions or interactions among the actors; the investments in specific assets made by the actors involved in the transaction (idiosyncratic investments); the information asymmetries among the actors involved in the transaction, and the number of actors involved in the transaction. These factors influence the behaviours of the various actors (human factors). For example, the higher the uncertainty, the higher the cognitive and/or information gap among the economic actors involved and therefore the frequency and intensity of opportunistic behaviours. Therefore, the analysis of environmental factors is fundamental to calculating transaction costs, choosing the configuration of the “efficient boundaries” in the value chain, and the related risks in terms of performance (quality, time-to-market, price, innovation, etc.).

In short, TCET argues that it is advisable to outsource for a specific value chain activity than to keep inside or insource decision-making when this means reducing cumulative production and transaction costs and when the risks for performance are low.

Outsourcing risks are low, so the transaction costs are also low under the conditions listed below.

1. *Uncertainty around the transaction relationship is low.* The complexity of the activity (difficulty in establishing the tasks and/or the actions to carry them out, such as setting performance targets) affects the level of uncer-

tainty. This is affected by environment complexity (the level of dynamism of the external context), too. The higher the level of uncertainty surrounding transactions, the higher the *ex ante* governance costs (i.e., the difficulty in drawing up and monitoring contract clauses and increasing the information exchange between the actors during the negotiation phase) and *ex post* costs (i.e., renegotiating contract clauses in response to unpredictable changes in the external context or performance targets; managing conflicts arising from uncertainty; increasing the information exchange to handle unpredictable events). Uncertainty can increase production costs *ex post* (forecast errors regarding the use of internal resources and assets and their costs), and – *ex ante* – the difficulty of evaluating the fair value of the prices on the supply market correctly (the risk of paying higher prices than the intrinsic value of the products or services).

2. *High transaction frequency.* When investments in idiosyncratic resources are high, it is difficult to offload them (or recover them) if the frequency of the transactions is low. Therefore, to use resources that have not been adequately employed, the transaction frequency must be sufficiently high. This can be accomplished in two ways. If the resources are highly idiosyncratic, participating in a high supply share with the only (or the few) suppliers with whom an outsourcing relationship has been established, on the one hand. On the other, when investment in the transaction is very high (capital intensive), it may be helpful to diversify the supplier portfolio for similar transactions. Thus, it is possible to suitably exploit the investments that have been made and the capabilities employed.

3. *Idiosyncratic investments (relation-specific assets) are low.* In TCET (Williamson, 1985, 1989, 1991), an asset's specificity (idiosyncrasy) and resources are the most critical element in the transaction. An asset or a resource is idiosyncratic when it cannot be used, or its potential use in transactions is limited, unlike those initially used. Thus, specific investments in activities or resources have no (or less) value when used for alternative transactions. When a transaction contract requires an economic agent to carry out investments in specific or idiosyncratic activities, other agents' risks and opportunistic behaviour costs increase. The *ex ante* and *ex post* governance costs are higher (governance infrastructures hardly usable in other transaction relationships; specifically dedicated human resources; a high information flow sustaining the negotiation phase and managing the relationship). The buying price itself is higher (the suppliers cannot carry out the activity for other buyers and cannot reach the optimal minimum that would allow them to exploit all the economies of scale and obtain the

lowest possible medium unit cost). Therefore, when transactions engage one of the high-investing agents in specific activities and resources, outsourcing or market solutions are not viable. In this case, a firm must keep the activities in-house, managing them according to their internal routines and organisational coordination mechanisms.

4. *There are no information asymmetries, or they are less critical.* Information asymmetries create a competitive advantage based on one of the agents involved in the transaction, having complete control of relevant information and knowledge. These asymmetries increase the costs of opportunistic behaviours by agents involved in the relationship benefitting from the information advantage. Information asymmetries arise from the uncertainty/complexity of the activity which the transaction is intended to fulfil. Complex activities require specific and qualified information and knowledge unavailable to both contracting parties in equal measure. These too arise from environmental uncertainty/complexity. So, for example, turbulent and hypercompetitive contexts require the availability, with adequate advance notice, of information regarding potential changes in environmental trends, which are not available in equal measure to the actors involved in the transactions. As previously mentioned, the costs arising from this moral hazard can be measured only if the transaction relationship actually exists (*ex post*).

Over the last few decades, TCET has proved to be a valuable and fundamental theoretical basis for interpreting decision-making regarding the firm's boundaries, namely which activities along the value chain to keep inside (make) and which to outsource to suppliers (buy). However, it also highlights several limitations to a deep and wide-ranging understanding of these decisions. Essentially, these limitations are embedded in the same theoretical assumptions of TCET, as follows.

- The firm is viewed as a portfolio of contracts rather than a system of assets, resources, capabilities, and competencies to be continuously improved, innovated, and supplemented with the contribution of external actors. From this perspective, TCET cannot fully explain the connection between outsourcing decisions and the dynamic growth of a firm's capabilities and knowledge portfolio.
- TCET focuses on transactions as isolated rather than interdependent episodes (the unit of analysis is the individual transaction and not the system of transactions). It argues that there is no obligation to separate commitment or governance requirements in decisions regarding transaction governance structure (Mahnke, 2001). According to Argyres and Libeskind (1999, 2000), a company's previous contractual obligations can limit future strategic transformations due to the in-

terdependencies and imperfect detachment of transactions. Therefore, decisions about the governance of transactions – whether to keep them inside or outsource them – takes into account the duties of previous contractual commitments. Therefore, outsourcing might not be a viable option due to previous contractual duties (i.e., exclusive long-term agreements with suppliers or dealers, or contractual duties with employers), or various other obligations (i.e., an excellent reputation obtained thanks to internal activities or adverse effects on the employers' motivation following the outsourcing of value chain activities).

- TCET asserts the hypothesis of the bounded rationality of economic actors involved in a transaction; however, it does not entirely reject absolute rationality. This appears evident when TCET argues that, for any transaction, a firm chooses the governance structure that minimises cumulative production and transaction costs.
- TCET supposes that all the switching costs arising from changes to the transactions' governance structure (keeping in-house, outsourcing, and collaborative relationships) can be defined beforehand, i.e., during the negotiation and decision-making phase. This would appear to confirm acceptance of the hypothesis of the decision-makers' absolute rationality. These costs are affected by the level of knowledge codification to be exchanged between the actors in order to perform and coordinate the shared activities. They are also influenced by how technological interfaces work to integrate the activities of the same actors and by situations of insufficient absorptive capacity (Cohen and Levinthal, 1990) caused by the cognitive distance of the actors (Noteboom, 2000). Only some of these costs can be foreseen and established before the relationship begins (*ex ante*). The majority of which emerge only once the outsourcing relationship is underway.
- TCET does not take into sufficient account the horizontal interrelations or synergies among a firm's different but connected activities and, consequently, the difficulty of separating them if this does not entail high costs. Horizontal interrelations work when several activities along the value chain share assets, resources, competencies, and knowledge. They are a huge source of a firm's competitive advantage in terms of lower costs (superior efficiency) and/or higher differentiation (superior effectiveness) than when it cannot exploit synergic interrelations. Horizontal interrelations are tangible if they come from sharing tangible assets and resources (e.g. operations, design assets) and intangible if they are due to sharing intangible resources (i.e., brand equity), knowledge, and (technological and managerial)

competencies. Horizontal interrelations give rise to connections and shared routines along the firm's value chain; they are the result of the interactive, co-specialized, and partially tacit learning processes adopted by those within a firm. Existing horizontal interrelations among different activities limit outsourcing opportunities because they might weaken the foundations of a firm's competitive advantage.

- Although TCET takes hybrid governance solutions (between the market and the hierarchy) into account, it does not explore alternative strategies to reduce outsourcing risks when transactions require substantial specific (idiosyncratic) investments in strategically important activities. Relationships based on trust, mutual dependence, sharing specific investments, "mutual hostage" mechanisms, and reputation might reduce the risks and costs of exchange relationships among firms, even those hard to define *ex ante*.

Scholars argue that TCET provides a valuable perspective from which to pursue the outsourcing decision-making process (Williamson, 2008; Cànèz et al., 2000) even though there are several limits to complete understanding, especially when it comes to core activities along the value chain, as in the case of NPD. However, outsourcing decision-making involving NPD and/or R&D processes (Becker and Zirpoli, 2017; Hsuan and Mahnke, 2011; Stanko and Calantone, 2011; Ambos and Ambos, 2011; Quinn, 2000) also impacts on the extension and integration of internal resources, competences, and the knowledge base. According to some theories and innovative managerial experience, a firm's internal resources are the main factors that generate value and competitive advantage. *Resource-based Theory (RBT)*, based on the seminal ideas of Penrose (1959), represents a breakthrough compared with previous strategy studies. The latter emphasises a strategic perspective "from the outside in" (Teece et al., 1999), ascribing significant influence in formulating competitive strategy and connecting a firm's advantage in to positioning in the industry (Porter, 1980) to environmental dynamics and business opportunities. On the other hand, in line with a strategic perspective "from the inside out", RBT argues the prevalence of internal conditions – the endowment of organisational resources and competencies – to explain the sources of a firm's competitive advantage. Over time, other epistemological theories and theoretical frameworks relating to the strategic field came to supplement RBT, sharing its central underlying tenets and assumptions. These include *Competence-based Competition Theory (CBCT)*, leveraging firms' architectural-component (Henderson and Clark, 1990) and core competencies (Prahalad and Hamel,

1990). *Strategic Asset Theory (SAT)* underscores the strategic assets that create the firm's competitive advantage (Amit and Schoemaker, 1993). *Capability Theory (CT)* highlights a firm's core (Leonard-Barton, 1992) and dynamic capabilities (Teece et al., 1997). *Knowledge-based Theory (KBT)* prioritises individual and collective knowledge resources accumulated over time and embedded in the places where they are created (Kogut and Zander, 1992; Spender, 1996; Grant, 1991, 1996a, 1996b; Vicari, 1991). *Network Theory (NT)* and *Supply Network Theory (SNT)* also contribute to the general theoretical background. They emphasise the concept of network resources (Gulati, 1999) as external resources embedded in a firm's network, able to leverage market opportunities and create value for the firm (Lavie, 2006).

2.3. Resource-Based Theory (RBT)

Resource-Based Theory (RBT) has not directly addressed the issue of a firm's boundary decisions and, consequently, those relating to outsourcing. However, it offers a theoretical background to explain some of the reasons underlying a firm's outsourcing decisions. RBT pays close attention to a firm's tangible and intangible assets to create value, develop, and maintain competitive advantage, creating barriers against competitors (Wernerfelt, 1984). From a holistic perspective, a bundle of resources owned by the firm (Barney, 1991) is a strategic asset when it is firm-specific and therefore cannot easily be separated from the company and brought onto the strategic resources supply market as it is the result of a resource accumulation process over time (Dierickx e Cool, 1989). Resources include the skills of the firm's employees and managers, its operation and design equipment, and the collective skills of the organisation (Penrose, 1959). Sanchez et al. (1996: 8) define resources as "assets that are available and useful in detecting and responding to market opportunities or threats. Resources include capabilities, as well as other forms of useful and available assets". These resources foster competitive advantage when they are durable, imperfectly transferable, and reproducible, and the firm can appropriate the rents earned from it (Grant, 1991: 123). Barney (1991: 5) argues that a resource provides a competitive advantage and sustainable performance when it is valuable, rare, imperfectly imitable and non-substitutable (the VRIN criterion mode). The more the firm is able to accumulate, replace, and renovate its unique resources, the more it will be able to create value and maintain its competitive advantage in business over time. Peteraf (1993: 180) argues that a firm nurtures competitive advantage when the four following condi-

tions or “cornerstones” occur from the RBT perspective. 1. *Resource heterogeneity* (resource superiority). Thanks to this heterogeneity, some firms are able to carry out the activities of the value chain with a higher level of efficiency and effectiveness than others, earning Ricardian and monopoly rents. The former arise due to some firms being endowed with rare superior resources or assets that could not expand rapidly (the scarcity of resources supply causes low imitability). Thus, firms endowed with these kinds of scarce resources have lower leverage costs and, consequently, higher profits and returns. The latter, on the other hand, result from restricted output due to imperfectly imitable product differentiation (high intra-industry mobility barriers) or spatial monopoly (Peteraf, 1993: 181-182). 2. *Ex post limits to competition* include the imperfect imitability and substitutability of the resources underlying the firm’s competitive advantage and the Ricardian and monopoly rents streams. “Isolating mechanisms” (Rumelt, 1984) protect competitive advantage in addition to *ex ante* limits to competition in order to prevent costs from offsetting the rents due to property rights, idiosyncrasy, firm-specific specialisation, switching cost, and co-specialization of resources, for example, in order to bind the rents to the firm.

In rapidly changing environmental conditions (such as shifts in technology and customer needs) and faced with the overwhelming pressure to compete by relying on new product innovation, “Resource-Based Theory discusses outsourcing as a strategic decision to fill gaps between the firm’s NPD resources and the desired NPD resources” (Rundquist, 2008: 429). Thus, from the RBT perspective, outsourcing NPD activities permits access to partners’ assets (i.e., specialised production facilities, engineering activities, laboratories, testing and certification activities, patents) that are difficult if not impossible to imitate or transfer among firms otherwise. Internally creating resources for innovation that can fulfil the VRIN criteria (Barney, 1991) and build competitive advantage – meaning that they must be valuable, rare, difficult to imitate, and impossible to substitute – is costly and time-consuming. From the RBT perspective, therefore, outsourcing NPD activities stems from a firm’s need to expand and supplement its own resources portfolio so as to force competition dynamics (resource-based competition). Especially when these new resources are valuable, rare, imperfectly imitable and non-substitutable, a firm might be convinced to establish relationships with suppliers possessing them. As we shall see later, Boeing 787 outsourced NPD activities as a response to the need to access resources (design and manufacturing resources) available in Boeing’s supply network in order to meet the strict objectives of the product innovation project, especially in terms of time-to-market (three years, a very short time

for the aeronautics industry), costs (highly competitive), and performance (disruptive for the industry).

2.4. Competence-Based Competition Theory (CBCT)

This theory argues that the competitive advantage of the firm arises from its distinctive competencies endowment. “Competence is an ability to sustain the coordinated deployment of assets in a way that helps a firm to achieve its goals, where the meaning of ability is the power to do something” (Heene et al., 1996: 8). According to Heene et al. (1996: 7), competencies have a conceptually different meaning from capabilities. The latter are “repeatable patterns of action in the use of assets to create, produce, and/or offer products to a market. Because capabilities are intangible assets that determine the uses of tangible assets and other kinds of intangible assets, we recognize capabilities as important special capabilities of assets”. The term ‘assets’ is understood here as “anything tangible or intangible the firm can use in its process of creating, producing, and/or offering its products (goods or services) to a market [...] capabilities are included within the term assets”. According to Prahalad and Hamel (1990: 79-91), “core competencies are the collective learning in the organisation, especially how to coordinate diverse production skills and integrate multiple streams of technologies”. In effect, competencies are involved in all the activities along the value chain. As an integrated set of skills, a core competence has three main traits (Hamel, 1994: 13-16). 1. It enables a firm to create and deliver exceptional value for customers (“customer value”). 2. It is competitively unique, not ubiquitous, and superior to any other competence possessed by the competitors (“competitor differentiation”), and 3. It makes it possible to enter new markets (as a “gateway to a new market”). In addition, Hamel (1994: 16-18) identifies three types of core competencies. 1. *Market-access competencies*, or business-linking skills creating and managing close and collaborative relationships with customers and other business actors (i.e., brand management, sales and marketing, distribution and logistics, customer care, customer relationship management, supplier management, etc.). 2. *Integrity-related competencies*, which help enable a firm complete product and/or service-related activities more effectively and efficiently than competitors (i.e., quality management, operations management, design management, inventory management, etc.), and 3. *Functionality-related competencies*, which allow a company to produce and deliver products and/or services with distinctive features and exceptional value for its customers (business sensing, new product development management, etc.). In CBCT, since the competition aims to accumulate, substitute, and innovate

dynamically distinctive competencies, outsourcing strategies might provide a way to access the external capabilities needed to be competitive. Through outsourcing, the firm puts in place mutual learning mechanisms with other business actors (learning interactions) together with coordination processes bringing together distinctive complementary capabilities that are imperfectly imitable and non-substitutable, except at very high costs and over a protracted timeframe. According to the tenets of CBCT, outsourcing product innovation activities should make it possible to access the stream of complementary, unique, and untradeable technological competencies of the NPD process that a single firm is not able, or has no wish, to keep in-house (Kristal et al., 2010; Azadegan et al., 2008). CBCT provides the best theoretical background for explaining NPD outsourcing decisions when product innovation changes the competencies-base underlying manufacturing, sub-assembling, and design activities (integrity-related competencies and functionality-related competencies), extending it outside the firm and involving supply partners, as the Boeing 787 programme highlights.

2.5. Strategic Assets Theory (SAT)

Strategic Assets Theory (SAT) considers a firm's strategic assets "as the set of difficult to trade and imitate, scarce, appropriable and specialised resources and capabilities that bestow the firm's competitive advantage [....]. Examples of possible SA include technological capability, fast product development cycles, brand management, control of, or superior access to, distribution channels, a favourable cost structure, buyer-seller relationships, the firm's installed user base, its R&D capability, the firm's service organisation, its reputation and so forth" (Amit and Schoemaker, 1993: 36). Therefore, the firm's capability to enter into effective relationships with suppliers is one of the key sources for building a competitive advantage. Strategic assets can generate and protect "organisational rents" if they have unique and superior characteristics matching current and future industry-specific "strategic industry factors" (or the critical success factors in the industry). Since strategic assets must co-evolve with the strategic industry factors, the supplier network – particularly in high-intensive innovation industries – is pivotal to the dynamic innovation of the firm's competitive advantage.

2.6. Dynamic Capability Theory (DCT)

Capabilities have a different meaning and role from resources and assets. "The manner in which a firm's resources are coordinated and managed is

at least as important to competitive success and survival as the identity of the resources themselves. Capabilities such as asset orchestration and market creation (or co-creation) are vital to profitable resource management” (Pitelis and Teece, 2010: 17). Capabilities arise in part from learning, from combining resources, and from exploiting complementary assets. Many capabilities become embedded in routines, and some are found in the top management team (Teece, 2019: 7). Indeed, the concepts of competence stated by Heene et al. (1996) and capability argued by Teece et al. (1997) and Teece again (2019) largely overlap. In this volume, we will use the two terms interchangeably. According to Teece (2019: 8), there are two distinct categories of organizational capabilities: “ordinary capabilities” and “dynamic capabilities.” The first are prevalently operational, while the second are strategic. “Ordinary capabilities, which encompass the operations, administration, and governance of the firm’s activities, allow the firm to produce and sell a defined (and static) set of products and services. Ordinary capabilities are embedded in some combination of (1) skilled personnel, including, under certain circumstances, independent contractors; (2) facilities and equipment; (3) processes and routines; and (4) the administrative coordination needed to get the job done. [...] Dynamic capabilities help enable an enterprise to profitably build and renew resources, reconfiguring them as needed to innovate and respond to (or bring about) changes in the market and in the business environment more generally (Pisano and Teece, 2007; Teece et al., 1997). They allow the enterprise and its top management to develop conjectures about the evolution of consumer preferences, business problems, and technology; validate and fine-tune them, and then act on them by realigning assets and activities. Strong dynamic capabilities support high performance based on new product (and process) development, a change-oriented organizational culture, and a prescient assessment of the business environment and technological opportunities. The corresponding managerial modes include asset orchestration, entrepreneurial agility, and forward-looking leadership. For applied purposes, dynamic capabilities can usefully be broken down into three primary clusters: (1) identification and assessment of threats, opportunities, and customer needs (sensing); (2) mobilization of resources to address fresh opportunities while capturing value from doing so (seizing); and (3) ongoing organizational renewal (transforming). Engagement in continuous or semi-continuous sensing, seizing, and transforming is essential if the firm is to sustain itself as customers, competitors, and technologies change (Teece, 2007)”.

Eisenhart and Martin (2000) see dynamic capabilities as processes using resources to address change and business challenges. Dynamic capability

thus means a firm's capability to innovate or adapt its set of competencies to address changes to the environment or bring them about. In highly changeable, unstable, and unpredictable markets where the industries' borders, the role of the business actors and the critical success factors are difficult to define (Eidsenhardt, 1989; Eisenhardt and Martin, 2000) where consolidated knowledge and competencies became obsolete in terms of competition, or rather, they become a disadvantage if firms continue to use them extensively (Argote, 1999; Eisenhardt and Martin, 2000; Teece, 2007).

Dynamic capabilities have a role of greater competence (Winter, 2003); they are able to innovate value propositions (product, services, market targets, and profit model), the firm's operating model (processes profitably delivering the value proposition), and create new specific knowledge and routines to be combined, of course, with some existing ones in order to address new competitive challenges (Eisenhardt and Martin, 2000). However, in moderately dynamic markets, where the change happens frequently but follows linear and predictable paths, exploiting codified knowledge (Nonaka, 1994; Eisenhardt, 1989; Zollo and Winter, 2002), dynamic capabilities trace the traditional concept of organisational routines. These are linear, predictable, and repetitive processes, depending on existing knowledge and execution modes (Eisenhardt and Martin, 2000), albeit with an incremental capacity for adaptation. Ultimately, a firm's resources and competencies portfolio underlines the increasing obsolescence of processes due to changes to the environment in which it works.

DCT thus recognizes a firm's ability to modify, supplement, build, reconfigure, and renew the combination of internal and external firm-specific competencies in order to survive in hypercompetitive and fast-changing environments. This typically occurs when a firm needs to develop product innovation projects requiring a different combination of resources and competencies, and those of the supply partners could have an essential role in fulfilling this aim. Therefore, over time, the network of supplier relationships with capability holders might change in terms of the number and mix of the components in order to have real access to new competencies and knowledge and pursue new approaches to building competitive advantage.

As we will see later on, the B787 was a challenging, innovative project for Boeing in which it dramatically changed the design and manufacturing paradigm of the industry. By doing so, Boeing brought about a revolutionary technological shift in which it addressed evolving customer needs, improving the value delivered to them (airline companies and passengers) and leapfrogging a strong direct competitor (Airbus). The project required a new combination of resources and capabilities, which, at that time, meant bringing onboard the best-in-class suppliers under the close coordination of Boeing management.

2.7. Knowledge-Based Theory (KBT)

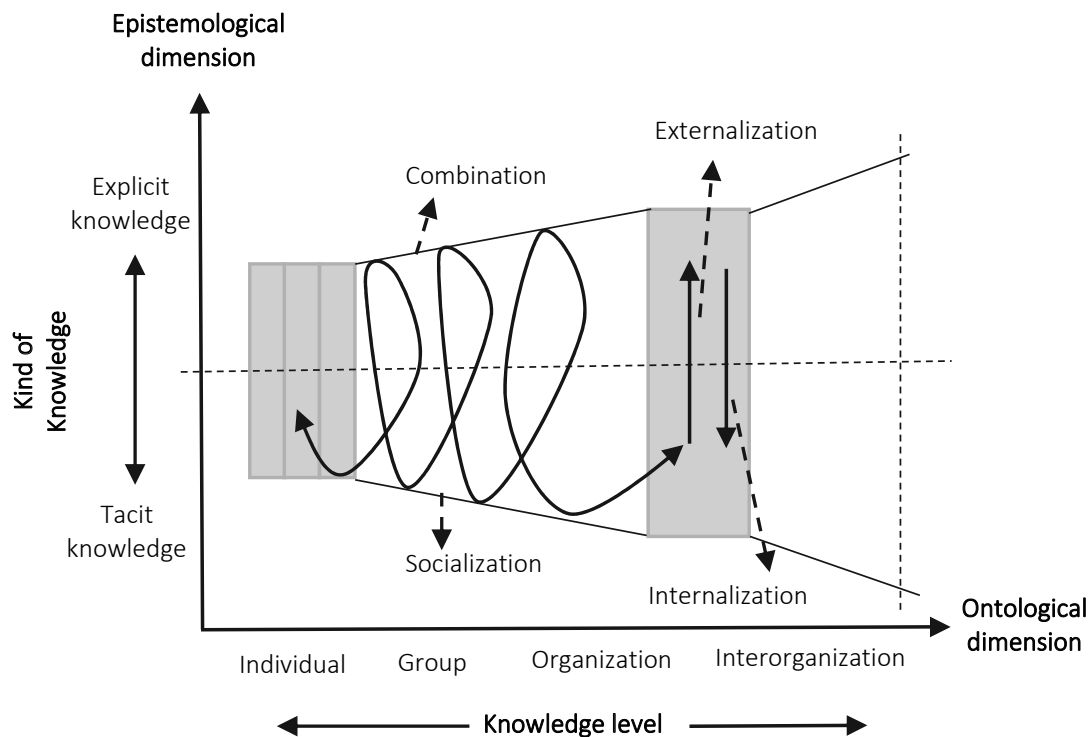
Knowledge-based Theory (KBT) envisages the firm as a portfolio of individual and collective knowledge resources. Knowledge fosters the capabilities, and the capabilities foster the activities or processes along the value chain, creating value for customers through the firm's products and/or services.

In the KBT theoretical framework, outsourcing relationships with specialised suppliers extend and integrate the technological and organisational knowledge base. KBT best explains outsourcing a firm's NPD activities when product innovation satisfies new customer needs and the product and process technology change radically. So, it is necessary to revolutionise the knowledge base underlying activities and processes. In other words, the firm accesses the complementary knowledge available to external actors in the business system by creating knowledge links (Badaracco, 1991) or knowledge networks.

The ability to combine (Kogut and Zander, 1992) and absorb (Cohen and Levinthal, 1990) are two leading mechanisms (meta-capabilities) for learning, absorbing, exploring and exploiting new knowledge. Absorptive capability is the "ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990: 128).

In line with the "knowledge conversion" model proposed by Nonaka and Takeuchi (1995: 62 and following), in the high-intensive innovation industries, NPD is a complex long-term process managed by several cross-functional teams, mostly involving external business partners such as strategic suppliers and key-customers as co-design partners (Becker and Zirpoli, 2017). Interaction between tacit and explicit knowledge occurs during the various stages of the innovation process and in the cross-functional teams involved in the co-design activities. In the first stage, the tacit knowledge, skills, and mental models are "socialised" and "embedded" in the cross-functional development team (conversion from tacit to explicit knowledge) by sharing and combining individual experiences, creating new perspectives and other tacit "sympathised knowledge". The socialisation of knowledge is necessary when new product development projects are carried out in collaboration with other firms (suppliers, key business clients, competitors). In the second stage, knowledge is "externalised", that is, it becomes "explicit, taking the shapes of metaphors, analogies, concepts, hypothesis, or models" (Nonaka and Takeuchi, 1995: 64) through communication. This concept-creation process results from collective reflection by the innovation team members, combining shared deductive and inductive reasoning (from implicit to explicit knowledge

conversion). In this creative process, the team leaders have a key role in revealing the tacit knowledge held by the innovation team and transforming it into a clear concept through metaphors and/or analogies. Externalization thus creates explicit new “conceptualised knowledge” from tacit knowledge. The third stage is the “combination” of different concepts or explicit knowledge that came to light during “externalisation”. Systemizing existing and explicit knowledge by the team members using collective and individual information exchanges creates explicit new “systemic knowledge” (from explicit to explicit knowledge conversion). The team members can use different modes to create systemic knowledge, such as discussion with other members of their own organization, databases, formal and informal knowledge networks, online repositories, or meetings. In this phase, new knowledge is created in the form of new product-service prototypes or new operation technologies. The fourth and last stage is the “internalisation” of explicit knowledge into tacit knowledge (from explicit to implicit knowledge conversion), cross-fertilizing, and re-experiencing the tacit mental model of most of the members of the organisation. “Internalization is a process of embodying explicit knowledge into tacit knowledge. It is closely related to ‘learning by doing’ and creates, therefore, operational knowledge. For explicit knowledge to become tacit, it helps if it is recorded or diagrammed in documents, manuals, or oral stories. Operational knowledge makes it possible to design, produce and/or sell new products, and manage new process technologies implementing the innovation. Documentation helps individuals to internalize what they experienced, thus enriching tacit knowledge. In addition, documents or manuals facilitate the transfer of explicit knowledge to other people, thereby helping them experience the experiences of others indirectly” (Nonaka and Takeuchi, 1995: 69). Ultimately, the process of internalisation can lead in time to tacit knowledge becoming part of a firm’s organizational culture. This new tacit knowledge can be “socialised” within an organization and/or with business partners, restarting the “spiral of knowledge creation”. Lastly, the stages of “socialization” and “externalisation” of knowledge occur strictly inside, among the inter-functional team (group level), stimulated by the team leaders. “Combination”, instead, is triggered via an outside-in approach, that is, the members of the team solicit and integrate knowledge embedded in other departments of the organisation (the organization level) and the business partners (the inter-organisation level) involved in the innovation project. Lastly, the “internalisation” stage involves three knowledge levels: individual, organisational, and inter-organisational.

Figure 1. – The spiral of organisational knowledge creation.

Source: Authors' adaptation from Nonaka and Takeuchi (1995: 73).

2.8. Open Innovation Theory (OIT)

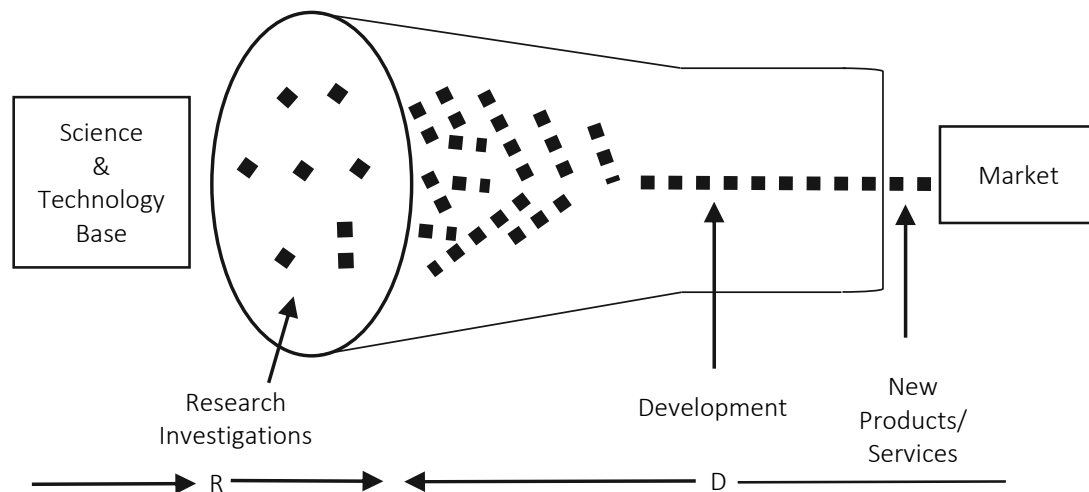
Chesbrough (2003a) argued that firms have shifted from a closed innovation process (Chesbrough, 2003b) towards an open approach to innovating because the latter approach makes it possible to overcome several limitations of the former (Chesbrough, 2003, 2004; Chesbrough et al., 2006; Lichtentahler, 2009; Chesbrough and Crowther, 2006), developing innovation projects, adding to and relying on the ideas and capabilities of other organisations. As Chesbrough (2006) and Henkel (2006) state, the stream of knowledge and capabilities is bidirectional, outside-in and inside-out. The former makes it possible to accelerate a firm's innovation process, leveraging the external innovation capabilities possessed by other actors (suppliers, lead users, competitors, distributors, other organisations); the latter, instead, makes it possible to exploit underperformed knowledge and technologies, making sure that they can be used better by existing firms or new enterprises (start-ups, spin-offs) on the market. In particular, most of the ideas, knowledge, capabilities, and resources strategic to new product development projects are outside the firms in high-intensive innovation industries. For instance, suppliers play an increasingly important role in the product innovation process in terms of ideas, technologies, processes, and

capabilities. Through cooperation with suppliers, a firm can improve the efficiency and effectiveness of the innovation process and, therefore, the value created for customers and itself. As Chesbrough (2003a) suggests, open innovation can involve all three stages of the innovation process: front-end innovation, observing and leveraging external sources (suppliers, customers, non-customers, start-ups, creative talents, inventors) to explore new solutions and/or new market needs; idea-generation and development, using technologies, patents, IPs, resources, the capabilities of external actors; as well as the commercialization of innovation on the market involving external channels (out-licencing, spin-off ventures, and so forth), together with internal ones.

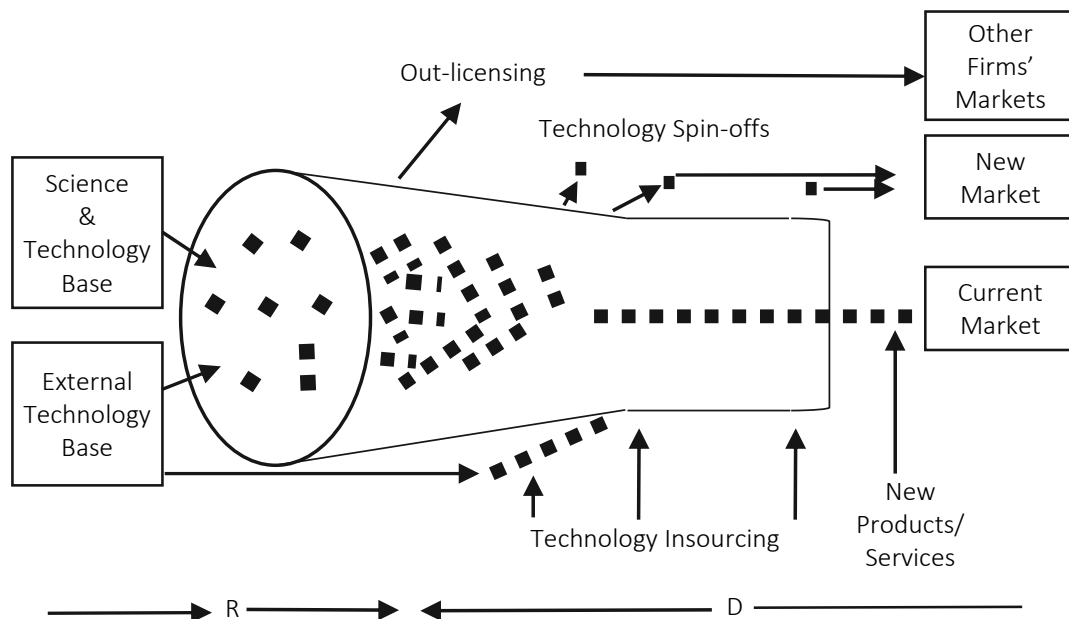
The Boeing 787 case study illustrates an open approach to innovation with prime suppliers' intensive and strategic collaboration (tier-1 suppliers) during the front-end stage and the idea-generation and development phases. In fact, for the front-end innovation stage, Boeing involved the leading worldwide airline companies as a means of understanding how best to satisfy customer needs.

Figure 2. – The open innovation model vs the closed innovation model.

The closed innovation model



The open innovation model



Source: Authors' adaptation from Chesbrough (2012: 22-23).

2.9. Network Theory (NT) and Supply-Chain Network Theory (SCNT)

In Network Theory (NT) and the related Supply-Chain Network Theory (SCNT), a firm's superior performance and competitive advantage (for instance, its product innovation advantage) might be heavily influenced by its business network or "strategic network" (Gulati et al., 2000; Dyear and Singh, 1998; Häkansson, 1987) and business relationships among partners.

Both NT and SNT argue that a firm's superior performance and competitive advantage may be strongly influenced by its inter-firm ties or its strategic network (Gulati et al., 2000; Dyer and Singh, 1998; Häkansson, 1987).

Gulati (1999) defines the strategic network as "valuable knowledge acquired through the network" (Dyer and Hatch, 2006: 702). Therefore, a firm participating in a strategic network can have access to "network resources" that will be useful for creating superior performance (for example, product innovation advantage) but which cannot be generated by the firm itself (Dyer and Hatch, 2006; Dyer and Nobeoka, 2000; Tsai, 2001).

Networks, working as an operational pattern of relationships among firms are (1) an alternative to markets and hierarchies (Powell, 1990); they are (2) the locus of innovation in high-technology industries (Powell et. al., 1996; Ahuja, 2000; Owen-Smith et. al., 2002; Pittaway et al., 2004) as they

form the shape and the diffusion of technologies (Rogers, 1962) and organizational practices (Davis and Pett, 2002); they accelerate (3) product-to-market (Almeida and Kogut, 1999); they act (4) as a key vehicle for obtaining access to external knowledge (Cooke et al., 1996; Powell et al., 1996; Kogut, 2000); they create (5) trust and increase forbearance (Piore and Sabel, 1984; Uzzi, 1997); they inspire (6) conformity of thought and action (Galaskiewicz, 1991; Mizruchi, 1992); they create (7) interactive relationships between selling and buying firms (Häkansson, 1982; Häkansson and Snehota, 1989, 1995; Dwyer and Schurr, 1987); they develop (8) a collaborative advantage (Schilling and Phelps, 2007; Hansen and Nohria, 2004; Dyer and Singh, 1998; Dyer, 2000; Cao and Zhang, 2011), and learning alliances (Doz and Hamel, 1998; Khanna and Anand, 2000); they are (9) the locus of value co-production (Norman and Ramirez, 1993) and value co-creation (Lush and Vargo, 2004, 2006; Chatain, 2010; Swaminathan and Moorman, 2009; Dobrzykowski et al., 2010), where the rigid distinction between customers and suppliers (or buyers and sellers) is superseded (Vargo and Lusch, 2011, adopt an actor-to-actor terminology).

Integrating the supplier network within the NPD process is recognized as one of the factors leading to frame-breaking innovation (Romijn and Albu, 2002; Kaufmann and Tödtling, 2001; Ragatz et al., 1997; Ritter and Gemünden, 2003), thanks to its massive impact on the relative competitive position of buying firms. In fact, suppliers can permit product success (Gemünden et al., 1992, 1996), access to specific technology, knowledge and expertise in the long-term (Cooke, 1996; Powell et al., 1996), accelerating time-to-market (Almeida and Kogut, 1999), improving quality, productivity, and lead time performance (Clark and Fujimoto, 1991; Quesada et al., 2006; Cao and Zhang, 2011; McIvor and McHugh, 2000), reducing costs and risk (Grandori and Soda, 1995).

NT, in turn, is based on other theories, as we will see below. The first of these is the *Resources Dependence Theory* (Thompson, 1967; Pfeffer and Salancik, 1978; Alter and Hage, 1993); according to this, firms constitute collaborative and coordinated relationships with other organisations to control environmental uncertainty. Another is *Exchange or Market Power Theory*; here, firms set up collaborative relationships with other firms to gain access to resources unavailable internally or to control the use of capabilities owned by these organisations thanks to the scope of their power and/or influence (Evan, 1966; Pfeffer and Salancik, 1978). According to *Reciprocity Theory* (Larson, 1992; Das and Teng, 1998; Haugland, 1999), firms build networked relationships with other organizations to earn more rents and to create and sustain their competitive advantage (Lavie, 2006). Then there is *Economic Inefficiency Theory*, whereby firms constitute col-

laborative inter-firm relationships so as to increase operating effectiveness and reduce transaction costs (Williamson, 1975; Davis, 1991; Turati, 1990; Teece, 1980). In *Resource Pooling Theory*, firms have collaborative relationships with other firms to gain continuous access to complementary knowledge from other organisations or share the risks of innovative business projects (Harrigan, 1985). According to *Institutional Theory*, firms set up collaborative relationships to obtain authorizations and comply with rules, including those of government and control organisations (Whetten, 1981; Leblebic and Salancik, 1982; Stern, 1981), which increases their legitimacy and reputation with the institutions (Di Maggio, 1988; Meyer and Rowan, 1977).

Networks are kinds of “hybrid organizational arrangements” (Powell, 1990, 1987; Bartlett and Ghoshal, 1989) representing power and trusted relationships through which organizations can exchange otherwise unavailable resources, cooperating to leverage reciprocal advantages (Borys and Jemison, 1989; Ebers, 1997). Organisations set up a variety of cooperative relationships with different aims and a variety of actors (i.e., suppliers, competitors, customers, local communities, business communities, Universities and Research Centres) that make up their relational ecosystem. In an institutional network comprising of legally distinct but profit-connected organisations, the allocation and control of resources come about differently compared with the consolidated mechanisms of the “market” (bargaining over prices) and the “hierarchy” (authority relations) because they are based on stable cooperation, reciprocity, negotiation, trust and reputation (Grandori and Soda, 1995). Granovetter (1985) argues that networked practices are embedded in the context of the social or interpersonal relationships within the network. Despite its underlying collaborative logic, the network does not eliminate competitive, opportunistic and authoritarian behaviours.

In NT/SNT, integrating the supplier network into the NPD process is one factor that drives frame-breaking innovation (Ragatz et al., 1997). Time-to-market acceleration, raising quality, productivity and operational performance (Cao and Zhang, 2011), together with cost and risk reduction, might represent further valuable benefits.

Both NT and SNT are theoretical frameworks explaining the outsourcing of NPD activities when business relationships are essential for co-developing “relationship value” (where the benefits exceed the costs of the relationship). They improve internal resources and/or competencies and/or develop new ones, providing access to and exploiting the external, complementary resources and competencies available inside the supplier network.

Many previous studies address the issue of Supply Chain Management (SCM) and its definition (LeMay et al., 2017; Lummus and Vokurka, 1999; Mentzer et al., 2001; Stock and Boyer, 2009). Stock and Boyer (2009) compiled 173 SCM definitions in the literature and suggested the following: “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to the final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction” (Stock and Boyer, 2009: 706). As a result of the attention to “network relationships” in Stock and Boyer’s definition, we believe that their approach is robust and suitable for understanding the complexities created by the various relationships in the product/service production process. However, their definition encapsulates neither the complexities of digital age transformation nor the disruption caused in the SCM. The following sections discuss the issue and suggest some ideas to improve SCM digitalization awareness in a “smooth way”, based on the Digital Supply Chain approach.

In terms of outsourcing decision-making, the resource-based theories of the firm and the recommendations of the transaction cost theory could be more closely interwoven. The reasoning behind TCET rests on a cost-based and short-term perspective. The approach adopted by the resources-based theories, on the other hand, attaches great importance to a long-term strategic perspective. Drawing these different theoretical views together would make it possible to build an interpretive model of outsourcing decision-making, broadening the variety and strategic importance of evaluative dimensions and thus framing the outsourcing decision-making in the broader strategic management process of the firm.

Lastly, the fusion of the various theoretical perspectives just examined (TCET, RBT, CBCT, DCT, KBT, NT/SNT) could help to clarify whether outsourcing decisions and the outsourcing relationships set up by a firm in its business system might seek to pursue a holistic set of objectives, as listed here. 1. Reducing the cumulative production and transaction costs as a solution to keep the activities in-house; 2. reducing fixed costs and therefore industrial and financial risk. The former would be due to the lower fixed costs and variable costs rate. The latter would be due to the lower debt/equity ratio and, consequently, the lower debt cost; 3. improving strategic and operational flexibility; 4. focusing investments on the value chain activities constituting the firm’s core competencies; 5. absorbing new competencies through collaborative relationships with suppliers (a competence-

learning strategy), and 6. developing new competencies through collaborative relationships with suppliers (competence-building strategy).

Some approaches in the literature have integrated both TCET and RBT (Stanko and Calantone, 2011; McIvor 2009, Holcomb and Hitt, 2007; Poppo and Zenger, 1998) like other resources theories (Arnold, 2000; Becker and Zirpoli, 2017) in order to explain the decision-making of strategic outsourcing, in particular outsourcing new product innovation activities. Therefore, the existing literature lacks a well-grounded approach allowing analysis of outsourcing decisions in relation to NPD activities from the perspective of all the theoretical paradigms discussed above, considered as a whole.

The decision-making model for outsourcing NPD activities proposed in this book (Chapter 5) incorporates a multiple and integrated set of dimensions rooted in the assumptions of all the above-mentioned theories.

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