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ARTICLE

Impact of IT offerings strategies and IT integration capability on IT vendor value creation

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ABSTRACT
While IT integration is recognised as an important capability, the mechanisms through which it creates value and the contingencies that delimit its effectiveness are unclear – particularly, in the case of firms that deliver solutions embodying both products and services. We focus on IT vendors to investigate the effectiveness of IT integration capability with respect to three aspects of IT solution offerings: breadth, modularity and customisation. We find a complementarity effect between IT integration capability and management of the IT offer strategy: IT integration is fundamental regardless of whether the firm relies on customisation or a broad set of heterogeneous knowledge bases. However, when IT vendors adopt a modular design strategy, IT integration is made redundant and can be counterproductive.

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1. Introduction

The issue of how to coordinate or integrate different elements – data repositories, product or service components, organisational functions, individual skills – in complex systems has, for a long time, attracted the attention of scholars in various fields, including management (Kogut & Zander, 1993; e.g., Grant, 1996; Nickerson & Zenger, 2004), organisation theory (e.g., Thompson, 1967) and management of information systems (e.g., Benitez, Ray, & Henseler, 2018; Grover & Saeed, 2007; Rai & Tang, 2010).

In the Information Technology (IT) sector, we observe pervasive diffusion of IT solutions, defined by Davies, Brady, & Hobday, (2006) as complex and tightly integrated bundles of products and services (Davies et al., 2006; Han, Kuruzovich, & Ravichandran, 2013; Umapathy, Purao, & Barton, 2008). IT solutions, similar to other solutions offered in the market, require integration among products and services. However, the nature of IT amplifies the integration problem: digitalisation creates novel challenges and opportunities for resource integration. In our specific case, the IT components included in an IT solution may require unique resource integration efforts and, in the case of systems integration, integration with additional components which then creates new opportunities for value co-creation (Lusch & Nambisan, 2015; Yoo, Henfridsson, & Lyytinen, 2010). While in the IS domain integration has often been studied from the client perspective, the question of how to coordinate the provision of different components, systems, or activities plays a fundamental role for IT vendors too. When clients seek customised IT systems that fit their unique characteristics, IT vendors try to address such needs by providing fully functioning IT solutions that include a variety of different components (e.g., financing contracts, after-sales support, user training, software and hardware). The increased heterogeneity of client needs and the corresponding proliferation of technologies and applications to address them, require IT vendors to include a large number of heterogeneous elements in their offerings. These elements need to interact and operate seamlessly and, are often based on different technologies and require different individual and organisational competencies. In this context, IT integration is crucial, and firms need to develop specific capabilities to manage this integration.

In the Resource-Based View (RBV), capabilities refer to the firm's capacity to perform an activity competently (Barney, 1991; Penrose, 1959). Similarly, IT integration capability refers to the IT vendor's ability to integrate components or subsystems, that is, to reconcile differences in data exchange and coordination standards, incorporate different hardware platforms, communication technologies and applications, and coordinate internal and external knowledge (Rai & Tang, 2010). For IT vendors, which are the focus of this work, IT integration capability is the primary mechanism that enables the coordination among components, subsystems and technologies internally or externally designed and manufactured (Cusumano, Kahl, & Suarez, 2015; Rai & Tang, 2010; Tanriverdi, Rai, & Venkatraman,

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2010; Umapathy et al., 2008). The literature recognises the importance of IT integration capability. Several studies explore its characteristics – especially from the point of view of the adopters of IT solutions (e.g., Bidan, Rowe, & Truex, 2012; Elamrani, Rowe, & Geffroy-Maronnat, 2006; Marciniak, Elamrani, Rowe, & Adam, 2014; Mitchell, 2006). IT integration capability constitutes the organisational capability that enables the firm to coordinate its external and internal knowledge bases relevant to its offers. However, our understanding of IT integration capability from a vendor perspective is still limited. To our knowledge, few studies delve into the mechanisms underlying how IT integration capability can contribute to the creation of business value for IT vendors.

While the existing research generally considers IT integration capability as positive, it tends to ignore the contingencies that might limit or amplify its effectiveness. Among such contingencies, particularly important are the different approaches IT vendors adopt to develop and design IT solutions, to maximise the value of their offering. We define such approaches "IT offering strategies". Previous work in the fields, mainly of management and industrial marketing, identifies three types of "IT offering strategies": (i) breadth, i.e., improving fit by offering clients a large variety of alternatives (Leiponen & Helfat, 2010). This is the case, for example, of Preva, a Swedish company, that offers production development, project management, system development, support and application operations, industrial cloud, and quality and compliance solutions; (ii) full customisation, i.e., providing highly specialised, fully customised products and services to attract and retain clients with unique needs (Chatain, 2011). Such an IT offering strategy is adopted by Eurodata, a medium-sized Italian IT vendor providing IT solutions for industrial automation, or by Cambio, a Swedish company that provides e-healthcare solutions; and (iii) modularity, which represents a compromise between customisation and cost-effectiveness, through the provision of standardised modules that offer some level of personalisation in a cost-effective manner (Baldwin & Clark, 2000). This is the case, for instance, for Micso, an Italian IT vendor that combines IT, software and modules to enable online connectivity services, to address the digital divide problems experienced by many Small and Medium-Sized Enterprises (SMEs). While the above conceptualisation is general enough to be applicable to several IS management domains, its operationalisation may be context-dependent. For instance, in the case of integrated software packages such as ERP systems, a breadth approach consists in offering customers standard module with a large variety of pre-configured process templates, and a set of turnkey solutions for all complementary products and services needed by the client. At the opposite end, customisation implies coding the ERP modules to adapt them fully to the client's processes and offering personalised business blueprinting services and dedicated financing solutions that fully match customer-specific needs. Lastly, modularity is deployed through the development of interfaces that allow for the adoption of pre-defined and interchangeable modules that guarantee sufficient customisation while reducing cost and also diminishing the dependence of the client from the ERP vendor (Lehrer, 2005; Uppström et al., 2015; Samara, 2015; Parthasarathy & Sharma, 2017).

The literature has somewhat overlooked the importance of IT integration capability for IT vendors and, particularly, the interplay between IT integration capability and the strategies IT vendors can adopt to manage their solutions. We suggest that studying such interplay is crucial. Previous studies show that the provision of IT solutions involves the integration of different strategies, but that none of them is clearly superior (Ceci & Masini, 2011). A better understanding of the relationship between IT integration capability and IT offerings strategies would clarify how and when IT integration capability can create value for IT vendors and clients.

To address these issues, we analysed a sample of IT vendors in four different countries. Our IT vendors category includes both IT companies (e.g., Microsoft) and their partners (e.g., Prodware, a French partner of Microsoft and vendor of Microsoft solutions). The remainder of the paper is organised as follows: Section 2 positions the paper within the extant literature and discusses the theoretical background to the study; Section 3 develops the research hypotheses; Section 4 discusses data collection; Section 5 describes the empirical analysis; Section 6 outlines the main findings; Section 7 presents the results and discusses implications for managers.

2. Literature review and theoretical background

Integration capability has attracted the attention of both management and Information Systems (IS) scholars. While organisation theorists focused initially on coordination and coordination mechanisms (e.g., Thompson, 1967), management scholars have been investigating the construct of integration. Within the RBV, authors argue that firms act as integrators of (internal and external) knowledge – see, for example, Grant, (1996), Kogut & Zander, (1992), Nickerson & Zenger, (2004). Integration capability can be considered a higher-order capability that enables the coordination of internally or externally designed and manufactured components, subsystems and technologies (Takeishi, 2001). In the IT domain, IT integration capability allows for both integration of the physical components of a product or service offering (e.g., by reconciling differences in standards for data exchange and coordination processes, incorporating different hardware platforms, communication technologies and applications) and the integration of the organisational or individual competencies required to deliver those products and services (Han et al., 2013; Hobday, Davies, & Prencipe, 2005; Rai & Tang, 2010).

The IS literature studies the value of IT integration focusing, especially, on the role of IT as an enabler of cross-functional integration, and on the relationship between the technical and cognitive dimensions of integration. Although much of the literature examines the difficulties related to technical integration (intended as data or software integration), some contributions highlight the importance of non-technical factors (Marciniak et al., 2014; Umapathy et al., 2008). While Marciniak et al., (2014) focuses on the adopter's point of view, their contribution also reflects what happens at the IT vendor level: cross-functional integration requires the integration of cognitive and managerial elements and cross-functional awareness; that is, the cognitive ability of the actors in an organisation to understand the interdependencies inherent in the business.

The diffusion of Enterprise Resource Planning (ERP) systems has increased the value of IT integration capability for IT vendors. ERPs have several features that induce potential adopters to choose IT vendors that are able to provide fully integrated packages. These are complex, arduous to install, and often require dedicated hardware. Furthermore, since ERP systems support the adopter's core business processes, they demand important business process re-engineering efforts and close collaboration between client and vendor (Duhan, Levy, & Powell, 2001; Seddon, 2014). As a result of the emergence of software as a service concept, IT vendors need not only to possess knowledge about their technical solutions but also to know how to adapt their IT solutions to different infrastructures and computing platforms (Ma & Seidmann, 2015). IT vendors rely on a wide supplier base, which can result in loss of control over the activities underlying design, production, sale and delivery of the solution. Therefore, these firms need the capability to integrate the software and/or hardware components and to service the elements included in their offering and manage the associated knowledge base (Ceci & Prencipe, 2008; Cusumano et al., 2015; Han et al., 2013; Umapathy et al., 2008) (see Figure 1).

The IT integration needs described above lead firms to adopt different strategies while designing their IT solutions: offer of more alternatives (Leiponen & Helfat, 2010), developing highly specialised, fully customised products and services for clients with unique needs (Chatain, 2011), comprising customisation and cost-effectiveness in a cost-effective modular architecture that provides some level of personalisation (Baldwin & Clark, 2000).

These three IT offering strategies, which we refer to as *breadth, customisation* and *modularity*, may or may not require the development of IT integration capability (or may need different levels of IT integration capability). Thus, their nexus with IT integration efforts is important. Also, these strategies are not mutually exclusive, which makes it important to understand their interrelationships. To our knowledge, none of these aspects have been studied in depth. To address this gap in the literature, we examine the value of IT integration capability of vendors and their different IT offering strategies (i.e., breadth, customisation, modularity) for adopting firms. We draw on the notion of alignment and extend the idea of cognitive integration from the IT adopter to the IT vendor context (Marciniak et al., 2014). For each of the IT offering strategies chosen, we describe the strategy, summarise the integration needs it generates and discuss whether these are addressed best by developing IT integration capability.

3. Hypotheses development

3.1. Relationship between IT integration capability and solution breadth

IT solutions require tailoring, that is, adaptation to client needs (Davenport, 1998). This can be achieved

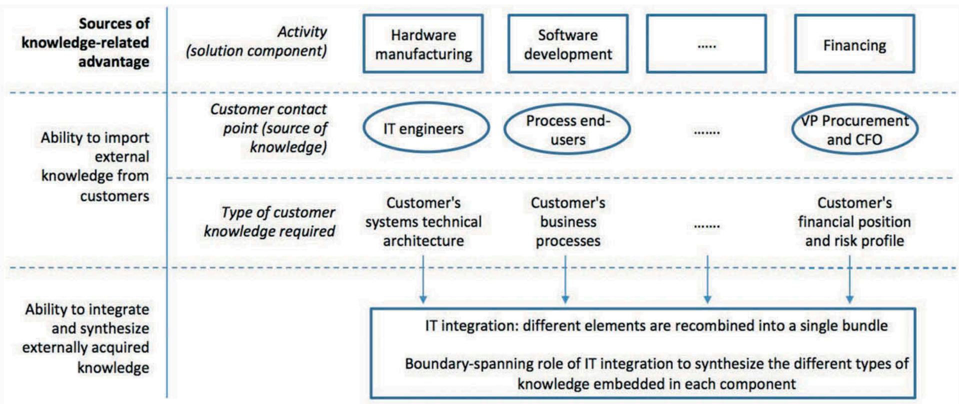

Figure 1. Sources of advantage and knowledge integration activities in the provision of IT solutions.

through substantial changes to the products and/or services included in the solution (i.e., changes to the software code) or by increasing the typologies of products offered. It has been shown that IT vendors, with more knowledge about IT systems, prefer to increase the variety of the products included in a solution compared heavy customisation of a few products (Brehm, Heinzl, & Markus, 2001). In this case, the fit with client needs can be improved by increasing, as much as possible, both the number of components within each IT solution and the number of alternatives within each component (Figure 2). In other words, the higher the number of choices, the higher the probability a client will find a perfect match with its needs.

We posit that IT vendors that prefer to increase the number of components within each IT solution and the number of alternatives within each component, adopt a breadth-based strategy to IT solution. In this scenario, the possibility to rely on a broad knowledge and capabilities base constitutes an important source of competitive advantage (Han et al., 2013; Leiponen & Helfat, 2010; Napier, Mathiassen, & Robey, 2011). This is consistent with some well-known competitive strategies. IT vendors who choose to emphasise breadth, *de facto*, leverage their internal knowledge base when defining their offerings, which supports the fact that firms tend to build on their current knowledge (Helfat, 1994; Umapathy et al., 2008). IT integration capability allows firms to process client knowledge, that is, it provides the capability "to understand what clients want and need, which enables them to intelligently anticipate desirable products and services and avoid embarrassing gaffes" (Simonson, 2005, p.6) and incorporate these products and services in their offers. This allows them to deliver solutions that better match their clients' expectations and have higher perceived value (Simonson, 2005).

However, a broad knowledge base can create coordination problems. Firms do not fail because of an inability to master new technological fields, but rather because of the gap between their coordination and control systems and the available technological opportunities (Pavitt, 1998). Also, the difficulty involved in knowledge recombination increases as the interactions among knowledge components increase (Fleming, 2001). Given that the various products chosen may not necessarily fit with one another (no integration efforts ex-ante), integration must be achieved ex-post, by the vendor. When a breadth-based design strategy is chosen, integration efforts primarily involve architectural knowledge – separately developed components must be linked together to form a coherent whole.

IT integration capability is particularly important for IT vendors, because it supports embedded service technologies such as control technologies for maintenance, remote diagnostics and system operations (Davies et al., 2006). It is not just the number of functions covered by the solution that increases the need for integration, it is also the extent to which the application covers the firm's core functions (Elamrani et al., 2006; Marciniak et al., 2014). When firms choose to increase the variety of their product/service offers, integration of the underlying knowledge bases can be accomplished only *ex post*, that is, after definition of the product/service architecture. This makes IT integration capability especially valuable because ex-post integration requires specific competencies, greater effort and, often, a dedicated team. Therefore, we propose:

Hypothesis 1: The relationship between IT integration capability and project performance is reinforced positively by the level of solution breadth.

3.2. Relationship between IT integration capability and solution customisation

Firms willing to match their offerings to unique client specifications often choose to adopt full customisation

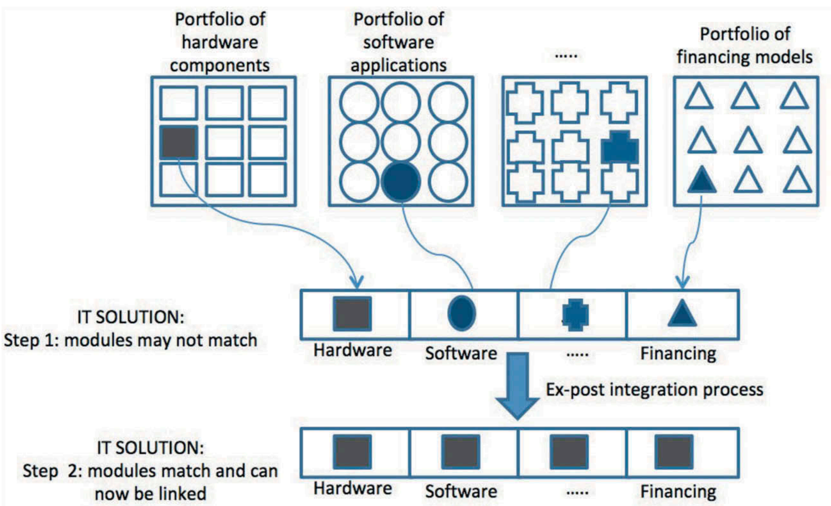

Figure 2. A breadth-based strategy to IT solutions.

(Chatain, 2011; Xia & Rajagopalan, 2009). In this case, each solution element is tailored completely to the client's specifications, in an iterative process in which IT vendor and client exchange information (Figure 3). In a customisation-based strategy, the components to be integrated in the solution are selected and designed in close cooperation with the client. Many of the components are developed on an ad-hoc basis, and their integration is guaranteed through continuous collaboration among the different functions involved in their development: understanding the clients' business process guides the development of the appropriate tools and technologies (Levina & Ross, 2003).

The competitive benefits of a customised solution strategy are clear. The development of dedicated components represents a transaction-specific asset that is likely to generate lock-in effects, in particular, as a result of the assistance and post-sales services that customisation often requires (Desyllas & Sako, 2013; Lampel & Mintzberg, 1996). In turn, lock-in effects increase profitability by altering the structure of the competition (Beggs & Klemperer, 1992), while the development of a close client/supplier relationship offers the possibility of acquiring client-specific knowledge which can be reused in other areas (Chatain, 2011; Chatain & Zemsky, 2007; Davis, Kettinger, & Kunev, 2009; Siggelkow, 2003). This generates client-specific economies of scale, cost savings and additional benefits based on collaboration between client and supplier in the design of the solution.

However, customisation can also be problematic, which can mitigate or negate its advantages. First, inefficiencies and production scale losses can undermine the advantage of a personalised solution. The optimal degree of customisation will depend largely on the needs and the level of sophistication of the client (Davies et al., 2006; Spiller & Zelner, 1997) and, therefore, on the client's willingness to pay a premium for dedicated features. As customisation increases, so does the number of exceptions processed by the firm. Firms that take on increased complexity can experience extensive coordination and control burdens (Vickery, Droge, & Germain, 1999).

Second, customisation presents specific knowledge integration challenges. To develop a customised solution, the IT vendor must integrate knowledge bases not entirely under its control because they originate from both vendor *and* client. Customisation requires advanced knowledge of client preferences (Pine, 1993).

Third, customisation involves difficulties related to the timing of the integration process (Lam, 2005). Precisely because firms that provide customised solutions learn about their clients' preferences only after development has started, the solution architecture cannot be defined *ex ante*. It must be defined as development proceeds through the continuous integration of new client knowledge. Knowledge integration must be enabled along the solution development and delivery phases, through continuous collaboration among the different functions involved in the development of the solution components.

In summary, the success of customised projects depends on extensive client participation (Stump, Athaide, & Joshi, 2002) to transfer "sticky" and time-shifting client preference information from client to IT vendor, and enable its rapid integration in the design process. Thus, dedicated capabilities are crucial for success. Therefore, we propose:

Hypothesis 2: The relationship between IT integration capability and project performance is reinforced positively by the level of solution customisation.

3.3. Relationship between IT integration capability and solution modularity

Modularity is a design strategy, based on the possibility to separate and recombine system components, allowing the mixing and matching of different modules in a cost-effective manner (Baldwin & Clark, 2000; Schilling, 2000). Each module performs a specific function and can be designed and improved independently; products designed according to modularity principles can be easily interconnected and bundled (Baldwin, 2008; Ulrich, 1995). Modularity is also seen as important in achieving IT flexibility, which is the firm's ability to support changes to the characteristics of its offers and modify linkages to partners with different supply chain

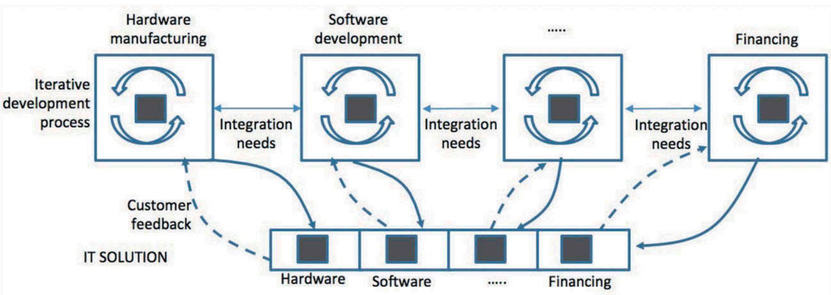

Figure 3. A full customisation strategy to IT solutions.

players (Benitez et al., 2018; Gosain, Malhotra, & EL SAWY, 2004; Rai & Tang, 2010). In this context, modularity can be defined as "the capability to reconfigure (i.e., add, modify or remove) and reuse IT components with ease and without any major overall effects" (Benitez et al., 2018: p.28).

Therefore, firms that choose a modular strategy pre-develop a portfolio of modules that can be incorporated quickly and easily in the IT solution (Figure 4), to enhance IT infrastructure flexibility (Benitez et al., 2018). As the adaptation of content and structure of modules ex-post might require extra-cost and extra-time, alignment to client needs is achieved primarily by selecting, *ex-ante*, the most appropriate module to match the client's needs.

Modularity offers several advantages: in addition to greater specialisation and flexibility, it helps firms to respond quickly to market forces through the introduction of new products, the extension of existing product lines and rapid product upgrading (Gosain et al., 2004; Sanchez & Mahoney, 1996; Schilling & Steensma, 2001; Voss & Hsuan, 2009).

However, modularity can raise difficulties: the choice to rely on modularity requires that modules can be recombined seamlessly across many configurations. In turn, this requires advanced knowledge of how components interact, to enable their separation and recombination (Schilling, 2000). Some scholars suggest that firms that need to coordinate and manage modular products must act consciously as system integrators (Brusoni & Prencipe, 2001), which increases the importance of IT integration capability. This was reinforced by Benitez, Ray & Henseler (2018), who show that IT infrastructure flexibility (composed also of modularity) has a positive relationship with IT integration capability and that this improves post-merger and acquisition performance.

However, we would argue that, in the context of IT vendors, modularity and IT integration capability present specificities that lead to different conclusions. Chari & Seshadri, (2004) classify the requirements for IT integration as: (i) the application itself (the application architecture); (ii) application integration requirements (integrating the application with other applications); and (iii) domain independence/dependence (standards and specifications generic or specific to vertical industry domain). The need for integration increases from (i) to (iii). IT vendors operate mainly at the first two levels. In the case of IT solutions, modularity influences the transfer of data between applications, sharing of IT application among different systems and rapid reconfiguration of IT applications (Chari & Seshadri, 2004; Kumar, 2004). In these cases, modularity allows for time and cost savings and has a positive impact on the value created by the IT solution project. A higher level of integration (i.e., domain independence/dependence) is not required. Therefore, in the case of IT solutions, we posit that modularity, per se, reduces the effort required for reconfiguring, adding, modifying and reusing the IT components included in the firm's offering (Chari & Seshadri, 2004; Rai & Tang, 2010; Tiwana, 2008).

In contrast to a breadth or customisation strategy, to enable module compatibility, the integration process must occur *ex ante*, before the solution architecture is defined (i.e., prior to the project execution phase). This applies especially to young firms that begin their activities designing offerings that incorporate ERP systems. In this case, knowledge integration can be planned and controlled easily. In the case of older firms that choose this strategy, ex post integration might require additional work. Marciniak et al., (2014, p. 869) states that the: "sequential introduction of selected modules seems to reduce integration capabilities benefits and weaken the ability to develop CFA (i.e., Cross-Functional Awareness)". We posit that modularisation of the architecture acts as a knowledge integration mechanism *per se*, which makes further dedicated mechanisms redundant (Tu, Vonderembse, Ragu-Nathan, & Ragu-Nathan, 2004; Voss & Hsuan, 2009). The need for dedicated IT integration capability is limited; the cost of its

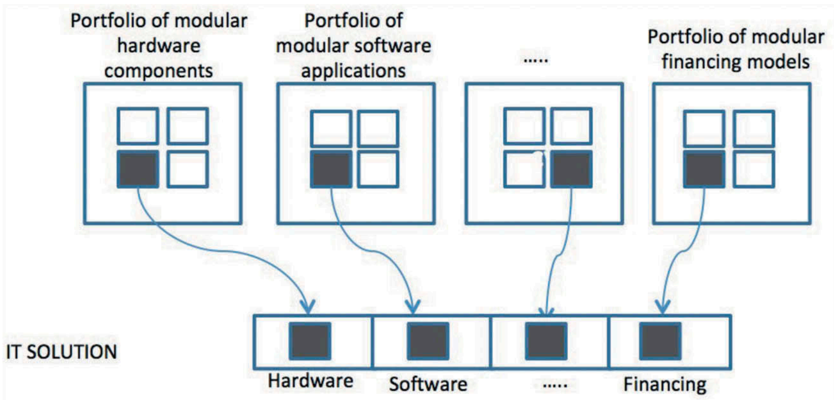

Figure 4. A modularity strategy to IT solutions.

development outweighs the benefits it produces. Thus, we propose:

Hypothesis 3: The relationship between IT integration capability and project performance is affected negatively by the level of solution modularity.

4. Research methodology

4.1. Data collection: sample selection and questionnaire administration

To examine the hypothesised relationships between IT integration capability and IT offering strategies, we analysed a sample of IT solutions providers. To select the target firms for this study, we drew on Davies et al.'s (2006, p. 39) definition of solutions as: "innovative combinations of technology, products and services as high-value-unified responses to their business customers' needs". This includes solutions offered by IT vendors (Levina & Ross, 2003; Rai & Tang, 2010), in which integration is central, and inter-organisational systems where compatibility and recombination are key (DE CORBIERE & Rowe, 2013; Sila, 2010).

The data collection process was accomplished in two steps: first, we used the literature and a case study approach to generate valid items to measure the relevant constructs: we investigated 10 IT vendors through archival data analysis and personal interviews. We combined data from the interviews with our literature analysis to establish a taxonomy of solutions capabilities and to generate items to describe solution characteristics. In the second phase of the data collection process, we coded the items within a questionnaire, which was administered by telephone to a sample of 160 IT vendors in Europe. One hundred and two usable responses were obtained as a result of this process.

To guarantee that our project-level data would provide reliable proxies for all the firms' activities, we selected respondents with direct personal involvement in IT solutions projects and asked them to consider a project that was highly representative of the firm's activities among the projects that generated the highest revenues for the organisation (Subramaniam & Venkatraman, 2001). The survey was addressed to project managers who had completed one of such projects in the year before the questionnaire was administered. Data on project performance – from the IT vendor perspective – was also collected via the questionnaire. They were double-checked and integrated (if required) using financial data obtained from the Amadeus Database of European Firms (a public database containing financial and business information on public and private European companies). Full details of the survey and its administration are provided in the methodological appendix.

4.2. Operationalisation of the variables

The variables in the model include both latent constructs, measured using formative composite multi-item scales, and observable measures assessed through single-item indicators.

The first group of operational measures pertains to the three IT offering strategies: breadth, customisation and modularity. Because we couch our analysis in the context of solutions, without loss of generality we can refer to solution breadth, solution customisation and solution modularity. The procedure used to measure solution breadth was based on the approach recommended in Sorenson, Mcevily, Ren, and Roy, (2006), using the widely adopted Herfindahl-Hirschman index (Siggelkow, 2003). We applied the Herfindahl-Hirschman index to the components and underlying organisational capabilities of IT vendors. First, we used multi-item scales to measure the intensity of the six main solution components: hardware and infrastructure manufacturing, software development, delivery, post-sales consulting, and financing. For each of these components, respondents were asked to indicate on a 5-point Likert scale: (i) the importance of the activity for their business; (ii) the frequency of its provision; and (iii) the percentage of related work conducted internally. These three items provide a measure of the internal organisational capabilities underlying the solution components. We then calculated the mean of these three items to allow their aggregation into a unique measure for each activity. Finally, solution breadth was assessed by computing a Herfindahl-Hirschman concentration index for all six organisational capabilities (Sorenson et al., 2006). Low levels of the index indicate that the IT vendor allocates resources homogeneously to a large number of solution components (potentially all). High levels of the index suggest instead that the vendor concentrates its efforts on a few-selected components.

The two latent constructs, degree of customisation and degree of modularity, were measured using multi-item indicators. The degree of customisation of the solution was calculated based on the degree of customisation of each of its individual components (i.e., hardware and infrastructure manufacturing, software development, delivery, post-sales, consulting and financing, excluding systems integration in order to avoid the risk of multicollinearity). For each component, the level of customisation was assessed according to the 5-point scale item 'this component was heavily customised around the client's specific needs'. The items pertaining to consulting and software development were subsequently removed during the model assessment phase because the signs of their weights were inconsistent.

The degree of modularity of the solution was operationalised in a similar way, using multiple items measuring the level of modularity of each component included in the solution (i.e., hardware and infrastructure manufacturing, software development, delivery, post-sales, consulting and financing). For each component, the level of modularity was assessed through the item "the offer of this component was modular", measured on a 5-point Likert scale. Similarly, to the case of customisation, two items – financial services and hardware and infrastructure manufacturing – were removed from the modularity scale during the measurement model assessment phase.

IT integration capability was defined as dedicated capability developed by IT vendors to integrate the different knowledge bases and satisfy integration requirements originating from clients' requests. The construct was operationalised based on the following four items, all pertaining to the activity "systems integration", and all measured on a 5-point Likert scale: (i) the importance to the business of systems integration; (ii) the frequency of its provision; (iii) the likelihood of outsourcing the activity; and (iv) percentage of related work conducted internally.

The three latent constructs customisation, modularity and IT integration capability, were all modelled as formative constructs based on composite measurement models (Bollen & Lennox, 1991; Fornell & Bookstein, 1982). Unlike the reflective scales, where the observed indicators are assumed to be caused by the latent construct, in the formative scales, the observed indicators are expected to cause the latent construct. Also, since eliminating relevant formative indicators would result in reductions in content validity, high correlations between formative indicators are not generally expected and internal consistency is not required (Jarvis, Mackenzie, & Podsakoff, 2003). Solution customisation, solution modularity and IT integration capability met all the above criteria: direction of causality from the indicator to the latent construct, non-interchangeability, no required covariation and different nomological net of indicators, and, therefore, were modelled as formative constructs.

Four observable control variables were included in the model, all measured through single quantitative indicators: firm size, client size, project value and the degree of servitisation (i.e., the percentage of service-based components in the solution). We measured firm size as the natural logarithm of the number of employees, client size as the natural logarithm of the number of employees in the client organisation, and project value as the cost of the project (1 = up to €50k; 2 = from €50k up to €100k; 3 = from €100k up to €500k; 4 = from €500k up to €1,000k; 5 = more than €1,000k). Servitisation was measured as the percentage of service-based components in the solution to total number of components.

Finally, we used profit per project as our dependent variable to measure project performance. Profit per project was calculated as the ratio of the profit generated from sales of the solution to the number of solutions projects conducted by the firm in the year of analysis. The data used to compute these performance measures were obtained partly from respondents (number of solutions) and partly from the Amadeus database (profit). This approach guaranteed that the dependent and the independent variables were from different sources. The self-reported measures were tested for Common Method Variance (CMV) using and the marker variable test (Lindell & Whitney, 2001). As a marker variable, we selected variable "age", which measures the number of years that the firm had been active at the time of data collection. Theoretically, this variable is unrelated to the substantive constructs of interest and has close to zero correlation with at least one of those variables, thus, showing no evidence of CMV.

Table 1 summarises the measurement items; Table 2 presents the inter-construct correlations.

5. Empirical analysis

The hypothesised relationships between IT integration capabilities and IT offerings strategies were tested using Partial Least Squares (PLS). PLS is a widely accepted variance-based approach to structural equation modelling which is commonly used in IS research. Besides being capable of testing for exact model fit and being suitable for confirmatory research, it has several additional advantages. PLS is appropriate in domains where theory and/or data are weak (Wold, 1985), it is not sensitive to statistical identification problems and it is particularly appropriate to estimate models that include one or more composite indicators such as the one used in this research (Benitez et al., 2018).

PLS path models were analysed using ADANCO (Dijkstra & Henseler, 2015), a modern software for variance-based SEM that is well suited for evaluating construct reliability, construct validity and overall model fit, and for testing hypotheses. The accuracy and significance of the estimates for both the measurement and structural model were assessed using a bootstrapping procedure (Gefen, Straub, & Boudreau, 2000) with 4,999 subsamples, a number that is sufficiently large to guarantee meaningful statistical results, while remaining tractable with respect to computation time (Benitez et al., 2018; Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). A bias-corrected and accelerated bootstrap procedure was used to adjust for possible deviations of the bootstrapping distribution from the empirical distribution (Hair et al., 2014). Multiple runs of the bootstrapping analysis were conducted, using a different random seed in each run. All runs were consistent, suggesting the size of the subsamples was adequate. All composite constructs were modelled using mode A in Adanco.

Table 1. Measurement items.

Construct	Measure	Item	Scale	Mean	StDev	VIF	Weight	
Breadth	Herfindahl-Hirschman index applied (for all solution components) to the average of: (i) importance of activity; (ii) frequency of its provision; (iii) percentage of related work conducted internally	B	0–100	63.278	19.592	-	-	
Customisation	"This component has been heavily customised around clients' specific needs" (question applied to all components in the solution).	Post-Sales (C1)	1–5	4.095	0.952	1.197	0.261	**
		Financial (C4)	1–5	3.119	0.547	1.110	0.300	*
		Hardware and Infrastructure Mfg. (C5)	1–5	3.060	0.588	1.026	0.208	*
		Delivery (C6)	1–5	4.000	0.957	1.198	0.686	***
		Consulting (C2)	1–5	4.143	1.020	Item removed		
		Software Development (C3)	1–5	4.036	0.924	Item removed		
	Average Weight						0.364	
Modularity	"The offer of this component was modular". Question applied to all components in the solution.	Post-Sales (M1)	1–5	2.590	1.095	1.240	0.208	
		Consulting (M2)	1–5	2.462	1.011	1.320	0.282	*
		Software Development (M3)	1–5	1.778	0.610	1.097	0.693	**
		Delivery (M6)	1–5	2.038	0.898	1.144	0.270	*
		Financial (M4)	1–5	2.636	0.478	Item removed		
		Hardware and Infrastructure Mfg. (M5)	1–5	2.538	0.360	Item removed		
	Average Weight						0.363	
IT integration capability	Importance of systems integration	S3	S3	0.548	0.701	1.465	0.201	*
	Frequency of its provision	S2	S2	2.500	1.401	2.422	0.020	
	Fequency of outsourcing (reversed)	S1	S1	1.940	1.347	2.982	1.114	
	Average Weight						0.445	
Firm size	Natural log of the number of employees in focal firm	Cont_1		4.401	1765	-	-	
Client size	Natural log of the number of employees in client organisation	Cont_2		0.763	0.439	-	-	
Project value	Cost of the project for the client (1 = up to €50k; 2 = from €50k up to €100k; 3 = from €100k up to €500k; 4 = from €500k up to €1,000k; 5 = more than €1,000k €).	Cont_3	1–5	0.981	0.55	-	-	
Servitisation	% of service components in the solution	Cont_4	%	0.612	0.113	-	-	
Profit per project	Profit generated from sales of solution to the number of solutions projects conducted by the firm in the year of analysis	P	M€	0.972	5.138	-	-	

Table 2. Inter-construct correlations.

Construct	1	2	3	4	5	6	7	8
1. Profit per project	-							
2. IT integration capability	−0.235	-						
3. Client size	−0.095	0.226	-					
4. Project value	0.075	0.291	0.643	-				
5. Servitisation	0.086	0.066	−0.033	0.050	-			
6. Firm size	0.055	0.075	0.321	0.454	0.279	-		
7. Modularity	0.102	−0.028	−0.090	−0.010	0.111	−0.006	-	
8. Customisation	−0.096	0.289	0.057	0.076	−0.073	0.041	−0.213	-
9. Breadth	−0.159	0.422	0.131	0.105	0.167	0.034	−0.056	0.568

5.1. Measurement model evaluation

To assess the nomological, convergent, discriminant and external validity of our measures, we followed Petter, Straub, & Rai, (2007) recommendations. For formative measurements, the assessment of validity cannot be achieved using the internal consistency perspective adopted for reflective models, because formative measures do not necessarily covary (Hair et al., 2014). For formative models, the focus should shift, instead, to the nomological validity of constructs and the level of fit of the overall model. Nomological validity was ensured by providing a solid theoretical grounding to the measurement items, based on a thorough literature review, and by submitting these items to expert validation via interviews with IT vendors. The convergent and discriminant validity of our composite constructs were checked by performing a principal components analysis. Unlike common factor analysis for reflective constructs, where factor loadings are examined, the principal components analysis for formative constructs should focus on weights. Following Diamantopoulos & Winklhofer, (2001) we removed items whose weights had signs inconsistent with theory. Based on this approach, the items pertaining to consulting and software development were removed from the scale measuring customisation, whereas financial services and hardware and infrastructure manufacturing were removed from the modularity scale. Customisation was therefore measured through the level of customisation of post-sales activities, financial services, hardware and infrastructure manufacturing and the delivery and installation of the solution. The formative scale measuring modularity included post-sales activities, consulting services, software development and delivery and installation. The purified scales with all items taping into each construct are displayed in Table 1.

After purifying the scales, the weights of all items tapping into the formative constructs ranged exceeded the recommended value of 0.1, with the exception of one of the items tapping into IT integration capability (frequency of provision of systems integration). Nonetheless, in line with Bollen & Lennox, (1991) we retained these items to guarantee that the constructs measured the entire domain and content validity was preserved. For all constructs, the average weights were smaller than the square root of 1/N (where N is the number of formative items tapping into each construct). Finally, the formative measures were assessed for multicollinearity examining the variance inflation factors of each item. VIF's values ranged from 1.02 to 2.98, well below the recommended threshold of 3.3 (Diamantopoulos & Siguaw, 2006), confirming that multicollinearity was not a concern in our measurement model.

Since our model included formative constructs, assessment of the external validity of the measurement model had to rely primarily on a test of model fit for the saturated model, a model that allows for free correlation among the measurements (Henseler, Hubona, & Ray, 2016). Goodness of fit of the saturated model was assessed by evaluating the standardised root mean squared residual (SRMR), the unweighted least squares discrepancy (dULS), and the geodesic discrepancy (dG) (Dijkstra & Henseler, 2015; Henseler et al., 2014). These indices measured the difference between the empirical correlation matrix and correlation matrix implied by the model (Benitez, Llorens, & Braojos, 2018; Benitez et al., 2018; Dijkstra & Henseler, 2015). Values below critical quantiles indicate good model fit. The results in Table 3 suggest that for our model, the values of these discrepancies are below the 95%-quantile (HI95 values), indicating that the measurement structure of our composite constructs is correct at the 0.05 level.

5.2. Structural model evaluation and analysis of moderating effects

After confirming the validity of our construct measures, we assessed the goodness of fit of the structural model and we tested the three hypotheses pertaining to the moderating impact the three IT offering strategies had on the relationship between IT integration capability and project performance. To test the moderating hypotheses, we used a two-stage PLS approach (Henseler & Chin, 2010), which is preferred to the traditional product indicator method for testing moderation in PLS when some of the latent constructs are modelled through formative scales (Fassott, Henseler, & Coelho, 2016). In the first stage, estimates for the latent constructs were generated from the direct PLS path model. In the second stage, the construct scores obtained from the first stage were used to build three interaction terms between each of the variables corresponding to the IT offerings strategies (breadth, customisation, modularity) and the moderating variable IT integration capability. These interaction terms were then used as independent variables in a second model, together with the latent variable scores of the three IT offerings strategies, the moderating variable and the control variables (Fassott et al., 2016; Henseler & Chin, 2010).

The structural model was assessed via its overall goodness of fit, its coefficient of determination, the significance of the path coefficients and the values of Cohen's f^2 statistics (Cohen, 1988), which measures relative changes in R^2 when the selected exogenous variable is included in or excluded from the model. Values above 0.02, 0.15 or 0.35 for the f^2 statistics indicate small, medium and large effects. The goodness of fit of the estimated model (first stage) was assessed by examining the values of the coefficient of determination and the SRMR, dULS, and dG (Benitez et al., 2018; Hair et al., 2014). Results for the estimated model (Table 4) indicate limited discrepancy between the empirical correlation matrix and the model-implied correlation matrix, as all discrepancies are below the 95%- quantile. The coefficient of determination was 0.124, a level deemed acceptable for this type of studies. The f^2 statistics indicated a small effect size for client size, project value and IT integration capability. Overall, the criteria indicated that the proposed model should not be rejected, and its results could be used for the moderating analysis.

In the second stage, the construct scores obtained from the structural model were used to generate three interaction terms whose impact on project performance was examined using PLS and multiple regression analysis with Ordinary Least Squares (OLS) estimation. The moderating effects were examined looking at overall changes in R^2, to the significance of the path coefficients of the interaction terms (resulting from the bootstrapping procedure) and to values of Cohen's f^2 statistics for the

Table 3. Goodness of fit of the saturated model.

	Value	HI95
SRMR	0.083	0.125
dULS	1.050	2.391
dG	0.298	0.508

Table 4. Goodness of fit of the estimated model.

	Value	HI95
SRMR	0.114	0.156
dULS	2.002	3.723
dG	0.774	2.567

moderating variables and the overall model. Table 5 summarises the results of the structural models for the direct and the moderating analysis, whereas Figure 5 displays the output of the PLS structural model. The results of second stage OLS regression are consistent with the PLS analysis and are not reported here for space considerations.

5.3. Empirical findings

The direct structural model suggests that none of the IT offering strategies considered in the model have a significant direct impact ($f^2 < 0.05$ for the three variables) whereas IT integration capability has a small negative effect on project performance ($f^2 = 0.053$). Most importantly, in line with Hypotheses 1 and 3, the results of the analysis indicate clearly that the role of IT integration capability is contingent on two of the IT offering strategy adopted by the firm, and suggest a moderating effect of IT integration capability on breadth and modularity ($f^2 = 0.119$ supporting H1 and $f^2 = 0.215$ supporting H3; $f^2 = 0.749$ for the joint moderated model).

Specifically, breadth has a moderate effect. Table 5 shows that the interaction term breadth × IT integration is positive and weakly significant and it has a medium effect size (Coeff. = 0.319, $p < 0.10$, $f^2 = 0.119$). This partially supports Hypothesis 1. Broadening the scope of the offers is a necessity, but not a sufficient condition for a profitable solution. Greater solution breadth demands mastery of a broad set of knowledge bases, but if not accompanied by the development of IT integration capability, a breadth-based strategy is counterproductive and reduces the profitability of the solution. The direct impact of breadth on project performance is negative. This implies that firms tend to overestimate the benefit (or underestimate the cost) of broadening their solution offering. A richer solution increases client satisfaction and may justify a premium price. However, to be profitable, it should be supported by the development of IT integration capability to compensate for the increased complexity and knowledge integration requirements embedded in this offering strategy.

Our results strongly support Hypothesis 3: the interaction term modularity × IT integration capability is negative and significant (Coeff. = −0.484, $p < 0.01$, $f^2 = 0.215$). Developing advanced knowledge of component interfaces, to design and implement modular

Table 5. Second-stage moderated PLS model.

	Path	Coeff.	StErr	t-value		f^2	Effect
Direct Model	Client size -> Profit per project	−0.203	0.231	−0.879		0.027	Small
	Project value -> Profit per project	0.289	0.242	1.193		0.047	Small
	Servitisation -> Profit per project	0.102	0.098	1.042		0.010	
	Firm size -> Profit per project	−0.017	0.088	−0.187		0.000	
	IT ICs -> Profit per project	−0.249	0.268	−0.930		0.053	Small
	Breadth -> Profit per project	−0.087	0.093	−0.942		0.005	
	Customisation -> Profit per project	0.043	0.130	0.332		0.001	
	Modularity -> Profit per project	0.072	0.213	0.336		0.005	
Moderated model	IT ICs x Breadth -> Profit per project (H1)	0.319	0.171	1.868	*	0.119	Medium
	IT ICs x Customisation -> Profit per project (H2)	0.112	0.161	0.694		0.011	
	IT ICs x Modularity -> Profit per project (H3)	−0.484	0.208	−2.324	***	0.215	Medium/large
	R2 (direct model)	0.204					
	R2 (moderated model)	0.545					
	f2 (model)	0.749					

*Significant at the 0.10 level. **Significant at the 0.05 level. ***Significant at the 0.01 level

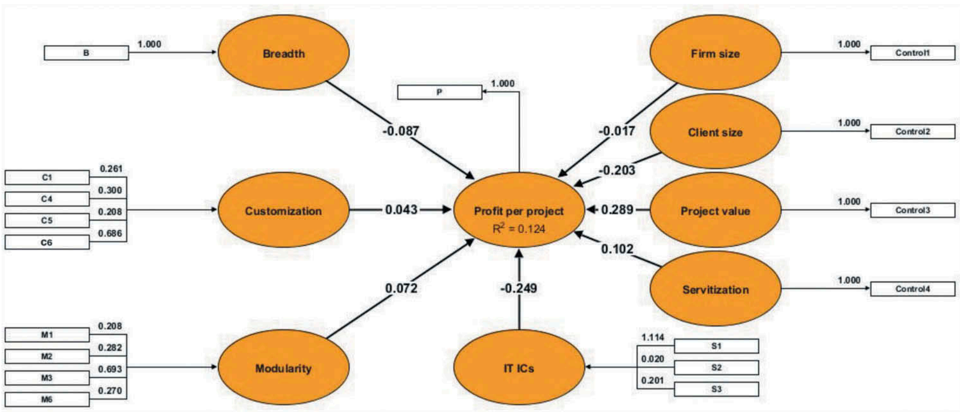

Figure 5. Direct PLS path model.

Table 6. Alignment between IT integration capability and IT offerings strategies.

		LOW	HIGH	*Total*
BREADTH				
IT integration capability	HIGH	32	**43**	*75*
	LOW	**20**	7	*27*
	Total	*52*	*50*	*102*
		*(p < 0.05**)*		
CUSTOMISATION				
IT integration capability	HIGH	30	**45**	*75*
	LOW	**18**	9	*27*
	Total	*48*	*54*	*102*
		*(p < 0.02**)*		
MODULARITY				
IT integration capability	HIGH	40	35	*75*
	LOW	10	17	*27*
	Total	*50*	*52*	*102*
		(p > 0.05)		

solutions, may be profitable. However, modularity makes the development of IT integration capability redundant, because clients can select and assemble the bundle of modules that best satisfy their needs, without specific assistance from the provider to integrate the systems.

Finally, the results provide only limited support for Hypothesis 2. The coefficient of the interaction term customisation × IT integration capability is positive but insignificant (Coeff. = 0.112, $p > 0.10$, $f^2 = 0.011$). Adapting solutions to client needs increases the value of solutions, but this effect does not seem to be significantly amplified or attenuated by the presence of IT integration capabilities.

To shed further light on the moderating role of the three IT offering strategies, we conducted a subgroup analysis for firms displaying either low or high levels of breadth, customisation and modularity, based on a median split of the sample. The analysis revealed that the three IT offering strategies are homologisers (Sharma, Durand, & Gur-Arie, 1981; Yu, Cadeaux, & Song, 2013) in that they moderate the strength more than the direction of the relationship between IT Integration capability and project performance. The coefficient of IT integration capability is positive but insignificant for firms with low levels of modularity ($\beta = 0.05$, $p = 0.52$). Conversely, it is strongly negative and significant for firms adopting high levels of modularity in their IT offering strategy ($\beta = 0.51$, $p = 0.03$). It is negative and moderately significant for firms with low levels of breadth or customisation ($\beta = -0.30$, $p = 0.09$ and $\beta = -0.37$, $p = 0.09$, respectively), whereas it is insignificant for high levels of breadth or customisation. Altogether these results confirm that IT integration is a redundant capability for firms adopting a modular IT offering strategy and, to a lesser extent, for firms that do not enrich or customise their solutions.

Interestingly, the coefficient estimates indicate that, for the range of IT integration capability values in our sample, the total effect of breadth and customisation is always positive (although very close to zero for low values of IT integration capability). Conversely, the total effect of modularity is almost always negative and decreases rapidly as IT integration capability increases. On average, the firms in our sample seem to have overdeveloped IT integration capability even in the case when reliance on modularity would recommend otherwise. This mismatch might be due to the inability of these firms to adapt their stock of capabilities dynamically to an evolving solution design strategy. When these firms began providing solutions (rather than only products or services), they concentrated first on breadth and customisation and then developed integration capabilities. Their later decision to produce modular solution designs made their accumulated stock of IT integration capability redundant, but it was too large and too sticky to be reduced immediately.

These results raise the question of whether these firms make a rational decision to develop IT integration capability that is aligned to their solution design strategy (or, similarly, whether they implement an offerings strategy aligned to their stock of capabilities). It is possible, also, that firms pursuing different offering design strategies might choose alternatives that are mutually reinforcing or hampering. To investigate these questions, we used a Fisher's exact test for differences in the number of firms with different levels of IT integration capability and which choose different offering strategies. The results (Table 6) suggest that firms tend to align their offering strategy to their IT integration capability stock: organisations with above-median values of solution customisation and solution breadth are more likely than their peers to develop IT integration capability, although the same does not hold for firms with above median values of modularity.

6. Discussion and conclusions

This study set out to understand the value of IT integration capability for IT vendors. IT integration capability is an organisational capability that allows IT vendors to integrate components, subsystems or knowledge required to offer complex products or services such as IT solutions. More specifically, our results make three contributions to the literature on the value of IT integration capability: firstly, we explored the role of IT integration capability from the IT vendor's (as opposed to the client's) perspective; secondly, we showed that IT integration capability is a source of competitive advantage for IT vendors only under certain conditions and confirmed the importance of the knowledge-related dimensions in IS management: thirdly, we investigated the relation between IT integration capabilities and three IT offering strategies. The literature focuses mainly on the role of modularisation and customisation; in our study, we include breadth as a possible strategy for IT vendors.

Related to the first point, previous contributions from IS explore IT integration capability mainly from the IT clients' perspective (Benitez et al., 2018; Bidan et al., 2012; Han et al., 2013; Rai & Tang, 2010; Umapathy et al., 2008) with the vendor perspective relatively unexplored. In this paper we conceptualised, developed and tested the role of IT integration capability from the IT vendor perspective and showed how IT vendors should manage this organisational capability to coordinate external and internal knowledge.

We suggest, also, that business value generation is contingent on the IT offerings strategy chosen by the IT vendor. The paper complements extant work by pointing to the pivotal role of knowledge integration for firm performance, and clarifying the contingencies that make this capability more or less valuable. Our study shows that the nexus between IT integration capability and performance depends strongly on the firm's specific solution design strategy – breadth, customisation or modularity. A complementarity effect exists between IT integration capability and two – out of three – of the IT offering strategies.

In contrast to the extant literature (Umapathy et al., 2008; e.g., Rai & Tang, 2010), we find that IT integration capability not associated to a specific IT offering strategy has a negative impact on firm performance. Alongside the complementarity argument developed below, we suggest that this result could be due to several interrelated reasons. First, according to the capability-based view of the firm, organisational capabilities are difficult to develop, maintain and nurture. The capability accumulation process is long and painstaking (Nelson & Winter, 1982) and is characterised by the interplay of specific properties, for example, time compression diseconomies, interconnectedness of asset stocks, causal ambiguity (Dietrickx & Cool, 1989), which amplify its demanding and challenging nature. A focus on the wrong set of IT integration capabilities may be due to the previously developed, specific organisational frame (Kaplan, 2008). based on competition in pure product-based or service-based offerings. This may have resulted in the eventual development of a specific, mono-dimensional set of IT integration capabilities. Again, although we would advise caution when interpreting this result which is based on cross-sectional data, this might suggest that there is no one-size-fits-all IT integration capability. Competitive conditions impose the need for different offerings and accompanying knowledge requirements, which, in turn, call for specific types of IT integration capability. As we proposed above, this finding allows an incremental understanding of IT integration capability, and extends and, in part, contrasts to previous findings by IS scholars (Umapathy et al., 2008; e.g., Rai & Tang, 2010). The projects context, in which this study is grounded, allowed us to capture this effect and to provide a more fine-grained understanding of IT integration capability.

Similarly, previous research shows that, in general, greater breadth of knowledge sources is associated to higher performance (Han et al., 2013; Napier et al., 2011). We extend this finding and show that pursuing knowledge breadth will guarantee superior performance only if the firm also develops IT integration capability. Firms that choose to leverage breadth and increase the scope of their offers face a corresponding increase in the number and complexity of the underlying organisational activities required to design, prepare and deliver the offer. In this context, IT integration capability is crucial for the recombination of (both product- and service-based) components into a seamless package. If the knowledge bases associated to this design strategy are not properly recombined, they will remain separate, stand-alone pieces of knowledge and will create no value. The potential advantages of integrating different knowledge bases will be exploited in full if the value of each activity is increased by the presence of an integration mechanism, that is, if the design strategy and the integration mechanism are complementary and mutually reinforcing (Milgrom & Roberts, 1990, 1995; Siggelkow, 2002). Conversely, if firms develop IT integration capability and use it effectively to manage the increased complexity resulting from greater solution breadth, they can secure important performance advantages.

On the other hand, IT integration capability might become counterproductive if the firm opts for a modular solution design strategy. Modularity entails the development of standardised solutions, organised into interoperable units that can be integrated and combined easily during the implementation phase. This applies especially to the case of young firms: in this case, knowledge integration can be planned and controlled straightforwardly, making development of dedicated IT integration capability (e.g., establishment of a team dedicated to systems integration) redundant and bringing minimal benefits compared to its costs. In such cases, knowledge integration is executed ex ante through the design of a modular architecture with modularity a stand-alone strategy. For the firms in our study, modularity is applied to consulting, software development, delivery and post-sales activities. In the case of software development, integration can be facilitated ex-ante, through the development of standard interfaces that allow for the replacement of a software component with another plug and play solution, with minimal need for software engineers to intervene ex-post. In such a case, hiring a dedicated pool of software engineers who are capable of making software components interoperable ex-post – i.e., developing specific IT integration capability – becomes clearly redundant. By the same token, for a firm selling business intelligence solutions, a modular strategy would entail designing the product in such a way that it can be easily plugged into the ERP systems of their clients, regardless of the type and vendor of the system, and without needing the development of ad-hoc interfaces. For such firm too, a pool of highly skilled software engineers capable of building such interfaces would represent a redundant resource.

Our findings challenge the findings in previous contributions (Benitez et al., 2018) since we found that, while configuring IT solutions, the level of integration between components required is satisfied by the modularity and does not require a higher level of integration. Conversely, if firms develop customised solutions and, especially, if they broaden the scope of their activities without modularising their systems, integration will require dedicated efforts and IT integration capability. Despite the advantages achievable through customisation, that is, the development of expertise advantages and client-specific economies of scope, pursuing a stand-alone customisation strategy presents risks due to the difficulties involved in minimising inefficiencies and losses arising from the increased production scope. IT integration capability would appear to be the solution to these problems and would reinforce the beneficial effects of customisation.

It is worth noting that while firms in our sample deploy both customisation and modularity consistently across post-sales and delivery, this is not the case for the other activities forming the two constructs. Customisation is also deployed through financial services and hardware and infrastructure manufacturing, whereas modularity concerns primarily software development and consulting. Therefore, the differences in the moderation effects of customisation and modularity could be partially due to the slight differences in the measurement scales for the two constructs. Some of the items retained in the moderation scale may have a stronger interaction with IT integration capability. This is the case, for instance, of software development – an activity for which modularity is usually extremely valuable and likely to make IT integration redundant.

Our results are in line with work that considers organisations as systems of elements (Miller, 1981; Milgrom & Roberts, 1990; Porter, 1996; e.g., Levinthal, 1997; Whittington, Pettigrew, Peck, Fenton, & Conyon, 1999). This perspective suggests that organisational elements play different roles and have different characteristics and that their interdependency determines organisational performance. Core elements represent critical activity domains (Hannan & Freeman, 1984; Rivkin, 2000). Elaborating elements reinforce and support existing core components, that is, they are complementary because the value of each individual component is increased by the presence of other elements. This view suggests a J-shaped relationship between organisational elements and performance: the magnitude of the performance effect from the combination of elements is greater than the sum of the effects from adopting each element individually (Ichniowski, Shaw, & Prennushi, 1997; Whittington et al., 1999). Our results support the previous intuition that IT integration capability acts as an elaborating element by reinforcing IT offering strategies and, eventually, enabling development of organisational configurations that allow higher performance.

This work has some implications for managers. We contribute to the debate on fit and equifinality in the provision of solutions. The fit hypothesis – that is, that firms can obtain similar levels of performance through different combinations of actions, as long as these actions are internally coherent – has emerged as an interesting angle from which to study solutions (Ceci & Masini, 2011; Davies, Brady, & Hobday, 2007). Building on the concept of fit as a moderator (Venkatraman, 1989), we confirm the validity of this perspective and identify several fit configurations (Bensaou & Venkatraman, 1995) for the provision of solutions – that is, IT integration capability and breadth, IT integration capability and customisation, and modularity.

Our results suggest a two-stage approach to knowledge integration and point to the presence of some path dependency. Bearing in mind the aforementioned caveats related to the effect of the organisational frame on the type of IT integration capability development, we suggest that there is no full equifinality in the knowledge integration process. For instance, managers may decide whether to invest in IT integration capability in the first stage, then choose an IT offering strategy. A firm that chooses to develop IT integration capability has two alternatives: breadth or customisation. It is only by leveraging breadth that it can achieve the highest performance, which is tantamount to saying that breadth and IT integration capability are super-additive elements. Implementing more of one of them increases the value of doing more of the second. Conversely, if managers decide not to develop IT integration capability, the firm is precluded from the most profitable configuration, but will still reap some performance advantages as long as it invests in modularity. Thus, we propose that, in specific cases, such as young firms, modularity and IT integration capability are substitute strategies. Managers might choose to follow an offering strategy before deciding whether to invest in IT integration capability. They can extend their offer to outperform their competitors, but only if they also develop IT integration capability to integrate the different knowledge bases underlying the extended offers. However, the development of IT integration capability is not a discrete decision and alignment of the IT integration capability stock to selected offering strategies takes time. When firms revert to an alternative offering strategy (i.e., modularity or customisation) because they cannot develop the heterogeneous capabilities required to expand their offer, they can still obtain some benefit by adjusting their investment in IT integration capability. Our investigation indicates that the integration of knowledge bases can be accomplished in different ways; selection of the most appropriate solution design should occur after an assessment of whether integration capabilities are available to the firm. The decision to develop (or not) IT integration capability should also be made according to the offering strategy adopted.

7. Methodological appendix

7.1. Sampling and administration procedure

To ensure sample homogeneity, the survey was restricted to four countries (the United Kingdom, Sweden, Italy and Spain), representative of the overall population of IT vendors in Europe, which offered favourable opportunities for data collection. To maximise response accuracy, most of the questionnaires were prepared in the native language of the respondents (the exception being Sweden which used an English language questionnaire). The survey initially was drafted in English and then translated into Spanish and Italian and back again (by different translators) to check accuracy and eliminate inconsistencies (Bensaou & Venkatraman, 1995). Items included in the questionnaire are the results of the combination of data from exploratory interviews with literature analysis. Additional information about items and the measures from the questionnaire is reported in Table A1.

Each version of the questionnaire was pretested with industry representatives to ensure that the target informants understood the wording, and that the Italian and Spanish versions were valid translations.

Sample selection was based on an ad hoc sampling procedure. In the absence of a database of IT vendors, we developed a procedure to estimate the population, from which we then extracted a sampling frame. First, we used the Amadeus Database of European Firms to construct the population of firms operating in the IT sector. Amadeus provides financial and business data for public and private European companies in 43 countries. It includes standardised annual accounts (consolidated and unconsolidated), financial ratios, sectoral activities and ownership data. Since firms that provide solutions generally are software houses, hardware producers or consultancy firms, we considered the following NACE codes: 3001, 3002 (manufacture of office machinery and computers), 7210, 7221, 7222, 7230, 7240, 7250, and 7260 (computer and related activities). We used the full version of the Amadeus database and considered all firms with at least 20 employees. We then selected a random sample of 200 firms and examined their websites to ascertain whether they provided IT solutions. This allowed us to obtain the percentage of firms operating in the IT sector that, besides of products and services, also offer IT solutions, stratified by the number of employees (Table A2). On the basis of this calculus, we estimated the dimension of the population of IT vendors. To select the sampling frame from this population of 3,042 firms (Table A3), we randomly chose 40 firms from each country to obtain a final sample frame of 160 firms. We obtained contacts for these firms from IT professional associations, alumni databases from business schools and universities, and distribution lists from specialised newspapers and chambers of commerce. For each firm, we controlled for its offering as described in the websites to ensure it was a provider of IT solutions. For instance, we included firms offering: IT outsourcing, technology consulting and solutions; consultancy, business intelligence and information systems strategy; architecture implementation, change management and training; TLC solutions; IT imaging solution; IT solutions for public transport; medical imaging/secure transmission solutions; infrastructure system for health sector; development, selling and implementation of ERP. This list of offerings results from the offers declared by our sample firms on their websites and during the interviews.

Following a multi-level methodology, we collected project level data and integrated them with performance indicators. This approach is consistent with our research aims: we want to investigate how IT vendors create value through IT integration capability, and whether the interaction between IT integration capability and IT offerings strategies increases the possibility of value creation. We believe that the relationship between firm strategy and firm performance is too complex to be explained only at the macro level and we recognise the importance of project management for firm performance (Hitt, Beamish, Jackson, & Mathieu, 2007; Marquis & Tilcsik, 2013). To be eligible to respond to the questionnaire, respondents needed to have direct and personal involvement in a solution project. To guarantee that the project level data we collected would provide reliable proxies for all the firm's activities, we asked project managers to consider a project that was highly representative of the firm's activities (within the class of projects that generated the greatest revenue for the organisation) (Subramaniam & Venkatraman, 2001). This identified the ideal respondent as a project manager who had completed a project representative of the firm's activities, in the year before the questionnaire was administered. To increase the response rate, we guaranteed that data would remain confidential and be used only for academic purposes; we also promised to benchmark each firm against a representative sample and to share this benchmark with the respondents.

Telephone interviews were used as the preferred data collection mode, because they enabled us to complement data from the questionnaire with qualitative information that might better characterise the firms. To set up the interviews, one researcher contacted the firms in the sampling frame via e-mail and made follow-up calls one week later. The researcher briefly explained the aim of the research and the content of the questionnaire and asked to arrange a telephone meeting with a project manager. This administration method yielded a 64% response rate, higher than many similar studies (Bensaou & Venkatraman, 1995; Miller & Roth, 1994). The final sample contained 102 firms (Table A2), 75% of which completed the questionnaire during the telephone interview and 10% during a face-to-face interview. For the remaining 15%, the survey was self-administered, and the researcher made follow-up calls, where necessary, to clarify responses. To maximise accuracy, the interviews were conducted in the native language of the interviewee (again except for Sweden, where the interviews were conducted in English). A Wilcoxon signed-rank test of firm size confirmed that the sample distribution was not significantly different from the wider population ($p = 0.019$). The dimension of the sample is in line with other studies on this topic (Marciniak et al., 2014)

7.2. Limitations

This study has some limitations. We used profits per project as the dependent variable; this variable captures only the profit dimension of the IT solution and does not reflect other ways to capture business value that might shed different light on our understanding of the phenomenon. Also, we measured the constructs "customisation" and "modularity" aggregating answers to a single-item question (respectively "this component was heavily customised around the client's specific needs" and "the offer of this component was modular"). Although we administered the survey using phone interviews and we explained the meaning of the items, respondents might have interpreted it in different ways. From an analytical viewpoint, we used cross-sectional data, which means the analysis is static rather than dynamic. We cannot infer any causal relationships, nor can we examine the consequences of IT integration capability over time. Moreover, we adopted structural equation modelling to analyse the data. We estimated the measurement and the structural model employing Partial Least Squares, which is more suited to handling formative indicators and relatively small sample sizes; unfortunately, this approach does not allow for robustness checks for endogeneity. Therefore, we acknowledge the possibility that endogeneity might be affecting the results. Finally, in this paper, we decided to investigate the generic market of "IT solutions" without focusing on specific technologies. While such an approach guarantees the generalisability of the conclusions to a larger set of systems and applications, it reduces the possibility of providing more concrete examples and some context-specific recommendations. Further research is needed to retest the proposed hypotheses in narrower and technology-specific context.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Table A1. Questionnaire data.

Firm and Project Characteristics						min	max	mean	st. dev.
Firm size [no. of employees]						13	75,000	1,331.67	7,671.53
Average project size [months]						6	48	17.49	12.99
Average project value [k €]						25	5,000	752.68	1,260.77
Level of customer satisfaction [1 = excellent; … 3 = average; … 5 = poor]						1	5	1.87	0.71
Please indicate your revenue breakdown [in %] by:									
Industry sector	min	max	Mean	st. dev.	*Client size*				
Agriculture	0	60	11.50	18.04	< 99 employees	0	100	47.39	33.54
Health	1	100	26.89	35.09	100–499 employees	0	100	36.00	26.96
IT	2	100	29.00	27.71	> 500 employees	2	100	64.93	32.75
Finance	5	100	25.36	23.20	*Project length*				
Manufacturing	3	100	32.19	29.73	< 1 year	0	100	64.02	30.91
Construction	0	100	24.64	35.68	1–2 years	0	100	31.12	20.78
Professional services	0	100	23.96	24.68	> 2 years	2	100	38.98	33.39
Transportation	3	100	15.67	22.10	*Project value*				
Public Administration	1	100	26.81	22.32	< 50k €	0	100	48.56	33.79
Wholesale, Retail	1	100	24.64	23.41	50k–100k €	0	100	30.61	21.31
Educational	1	90	17.07	22.51	100k–500k €	0	100	29.11	22.01
Entertainment, Tourism	3	80	22.67	26.77	500k–1000k €	0	100	22.05	17.47
Other	3	13	9.00	4.24	> 1,000k €	4	100	36.85	31.87
Please describe the characteristics of your business by agreeing/disagreeing with the statements below [1 = Strongly Agree; 2 = Agree; 3 = Indifferent; 4 = Disagree; 5 = Strongly Disagree]									
This activity is a key activity in our business.					This activity is usually performed in every project.				
	min	max	Mean	st. dev.					
(1) Post-Sales	1	4	1.56	0.81	(1) Post-Sales	1	4	1.73	0.92
(1) Consulting	1	4	1.51	0.84	(1) Consulting	1	5	1.94	1.04
(1) Software Development	1	4	1.51	0.77	(1) Software Development	1	5	2.01	1.09
(1) Financial	1	4	2.31	1.08	(1) Financial	1	5	2.25	1.13
(1) Hardware and Infrastruct. Mfg.	1	5	2.79	1.63	(1) Hardware Infrastruct. Mfg.	1	4	2.14	1.03
(1) Delivery	1	5	1.71	0.88	(1) Delivery	1	5	1.87	1.01
This activity has been heavily customised around customer specific needs [1 = strongly disagree … 5 = strongly agree]									
Post-Sales (C1)						1	5	4.095	0.952
Consulting (C2)						1	5	4.143	1.020
Software Development (C3)						1	5	4.036	0.924
Financial (C4)						1	5	3.119	0.547
Hardware and Infrastructure Mfg. (C5)						1	4	3.060	0.588
Delivery (C6)						1	4	4.000	0.957
The offer of this component was modular [1 = strongly disagree … 5 = strongly agree]									
Post-Sales (M1)						1	5	2.590	1.095
Consulting (M2)						1	5	2.462	1.011
Software Development (M3)						1	4	1.778	0.610
Financial (M4)						1	4	2.636	0.478
Hardware and Infrastructure Mfg. (M5)						1	4	2.538	0.360
Delivery (M6)						1	4	2.038	0.898
Please indicate the % of work done internally for each of the following activities [0 = none; 1 = ≤ 20%; 2 = 21%–40%; 3 = 41%–60%; 4 = 61%–80%; 5 = 81%–100%]									
Post-Sales						1	5	3.41	1.16
Consulting						1	5	3.00	1.26
Software Development						0	5	2.63	1.75
Financial						0	4	1.00	1.32
Hardware and Infrastructure Mfg.						0	5	1.91	1.76
Delivery						0	5	3.25	1.48

Table A2. Percentage of IT vendors operating in the IT sector.

Number of Employees	Percentage of IT vendors
20 to 99	47%
100 to 499	50%
500+	100%

Table A3. Population and sample characteristics.

	Location	Number of Employees 20–99	100–499	500+	Total
Firms in the IT sector (source: Amadeus database)	United Kingdom	1,791	792	202	2,785
	Sweden	610	131	29	770
	Italy	895	293	65	1,253
	Spain	813	301	56	1,170
	Total population	4109 (69%)	1517 (25%)	352 (6%)	5978
Firms offering solutions	United Kingdom	842	396	202	1,440
	Sweden	287	65	29	381
	Italy	421	147	65	632
	Spain	382	150	56	588
	Total population	1932 (63%)	758 (25%)	352 (12%)	3042
Sample	United Kingdom	16	4	7	30
	Sweden	12	7	4	23
	Italy	20	6	4	30
	Spain	11	5	3	19
	Total	62 (61%)	23 (22%)	17 (17%)	102