An organisational change framework for digital servitization:

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One-sentence summary:

Product firms implementing integrated product/service solutions through in-house development must have a long-term commitment to the project and focus on enhancing their resource base and strategic agility.

Summary:

The adoption of integrated solutions in digital business models seems to enhance product-firms' competitiveness. Our results confirm the importance of organisational capabilities and strong firm commitment to the development of integrated solutions.

While previous studies have demonstrated the importance of the service business unit's configuration, this paper identifies critical variables (the firm's strategic agility and capability) that influence make-or-buy decisions.

Firm agility is composed of speed and accuracy. Agility is a pre-requisite for digital organisational transformation, and our results corroborate that weak firm agility is closely linked to the need for external development of integrated solutions.

Keywords: Organisational change, servitization, strategic partnership, regional analysis.

J.E.L. classification codes: L2

Introduction

Fast-changing technologies and increasingly demanding customer requirements in maturing markets have paved the way for constant transformation of business models as a way to create value and grow. In this context, digital technologies are increasingly important (De Propris, 2016), as they enable upgrading of manufacturing activities and facilitate development of integrated product/service solutions (Baines *et al.*, 2016). To date, however, very few empirical studies have systematically investigated the organisational change processes involved in development of new integrated product/service business models.

Such integrated solutions in the digital domain are a symbiosis of smart products (Porter and Heppelman, 2014), digitization of supply (Coreynen *et al*., 2016) and advanced services including software and censors (Baines and Lightfoot, 2013), in a process known as *digital servitization* (Vendrell-Herrero *et al.*, 2017). Digital servitization includes different technology-enabled business models that enable firms to achieve a competitive advantage by providing customer knowledge-based digital services during the entire product life-cycle.

Reconfiguration of business models requires an organisational effort for continuous adaptation to the market's environmental conditions. In this context, manufacturing firms integrate products and digital services in *digitally-enabled integrated solutions* based on better understanding of customers' needs (Windhal *et al.*, 2004) and enabled by digital technologies (Martinez *et al.*, 2010). Such customer-oriented business models affect the entire value chain (Bustinza *et al.*, 2013) and are conducive to subsequent processes of organisational change (Vendrell-Herrero *et al.*, 2014).

Organisational change is a challenge for firms that are forced to reconfigure their strategic business units to integrate service into the production system while sustaining competitive advantage (Bustinza *et al.*, 2015). Current debates on servitization (Einola *et al.*, 2016) indicate that companies that have initiated their transition to provision of digital

integrated solutions face organizational tensions, mostly because they lack internal capabilities. In this article, we argue that effective service implementation is linked to critical organisational capabilities, especially those responsible for successful organisational change. To this end, our study contributes to the existing body of knowledge by developing and testing a comprehensive framework for organisational change that takes into account both firms' resources and competencies (Helfat and Peteraf, 2003; Wernerfelt, 1984), and their strategic agility (Webber and Tarba, 2014). An important contribution of this framework is its inclusion of commitment as the glue that facilitates the transformational process that enhances value creation.

The context of analysis is Veneto. One of the most economically vigorous (NUTS 2) regions in Italy, Veneto has a long-standing tradition in manufacturing (Unioncamere Veneto, 2016). It provides an important context because it grants us access to a large number of firms implementing cutting-edge business models in dynamic environments. The study is based on primary data; our industry partner, the Veneto Chamber of Commerce, surveyed 736 manufacturers, one third of which offer digitally-enabled integrated solutions. Our survey data also provide information on whether these firms resort to external service providers to integrate digital services into their product offerings.

Theoretical Foundations

Organisational change framework for digital servitization

Changing to digital servitization requires an organisational structure with the capacity to reconfigure the firm's strategic capabilities constantly to meet continuously evolving customer needs (Baines *et al.*, 2016). Companies embarking on the servitization journey cease to offer complementary product services to offering customized product and technologically-enabled digital service bundles (Martinez *et al.*, 2010). Most of the extant

literature considers digital servitization implementation as following sequential stages (Brax, 2005), positioning product-service offers on a continuum from products with services as an "add-on" to services with tangible goods as support (Gebauer and Friedli, 2005). In this vein, Oliva and Kallenberg (2003) consider the firm's total number of products in use as the product-installed base (IB), where IB services represent the increasing range of related digital services over the useful life of a product. The transition then follows three stages: a) consolidating product-related service offerings, b) entering the IB service market and c) expanding to relationship-based digital services.

Along these lines, Baines and Lightfoot (2013) propose that the product-service continuum follows three stages: a) base services–outcome based on product provision, b) intermediate services–outcome focusing on product condition and c) advanced services–outcome focusing on capability. Research then shows that the transition to offering digital integrated solutions is a strategic decision with profound implications for manufacturers (Vandermerwe and Rada, 1988), as it can require the commitment to allocating critical organisational resources during the different servitization stages. It may be several years before digital servitization adds value to the organization (Bustinza *et al.*, 2015), and organisational commitment is a prior condition (Kowalkowski and Kindström, 2013).

But resource allocation and commitment are not sufficient to enact the organisational change required to implement digital servitization. Digital service innovation in manufacturing contexts requires creation of economies of scale plus generation of user-oriented capabilities in digital services, both of which contribute to development of customized integrated solutions (Jawwad *et al.*, 2017). In this context, strategic agility seems to be critical, as it incorporates the ability to remain flexible when facing new developments, while being able to adjust continuously to change and sustain value generation (Buyukozkan *et al.*, 2008; Weber and Tarba, 2014). Strategic agility is useful for responding in a timely

manner to growing strategic discontinuities, where the need for speed is a critical dimension of strategic agility in rapidly and continually changing environments (Swafford *et al.*, 2006). It is commonly acknowledged, however, that speed without precision generates errors, making it particularly important for organizations to be able to develop accuracy competencies (Wu *et al.*, 2006).

As depicted in our framework of organisational change in Figure 1, a global set of critical variables is necessary for achieving organisational change to digital servitization. On the one hand, resources and competencies are required to configure the resource base that the firm needs for the transition to servitization. On the other, speed and accuracy are critical variables associated with the strategic agility required for developing successful new business models (Weber and Tarba, 2014). To ensure that this set of variables is aligned with the organisation's strategic objectives, commitment should play a central role (Selvarajan *et al.*, 2007; Wiener, 1982), since it facilitates the capacity for achieving strategic business unit adaptability and environmental alignment simultaneously (Boxall, 1996; Junni *et al.*, 2013; Zhou *et al.*, 2013). The next section develops the empirical hypotheses by discussing the interrelation of this set of variables in the context of servitizing firms facing organisational change processes.

[Insert Figure 1]

Hypotheses development: The importance of a firm's resource base, commitment and strategic agility in the process of organisational change to digital servitization

The foundations of the resource-based view of the firm consider companies as a collection of organisational resources and competencies (Helfat and Peteraf, 2003; Wernerfelt, 1984). This traditional view of the firm considers the firm's unique resources and core competencies as determining its competitive advantage through either lower costs or differentiation (Chandler,

1990). The dynamic relationship between organisational resources, competencies and the changing environment is useful for seizing opportunities and maintaining the firm's competitiveness (Teece, 2007). In this context, firms with the capacity to explore and innovate in the use and deployment of their internal resources and competencies will be able to provide new digital services or expand the base of existing ones when necessary, aligning their differentiated portfolio of offerings with current competitive market pressures (Davies and Brady, 2000). Providing new digital services enables development of integrated solutions, an increasing tendency in manufacturing firms worldwide (Bustinza *et al.*, 2015) and a challenge that most of these firms are beginning to face (De Propris, 2016). These arguments ground our first hypothesis:

H1: Firms with strong resource base are more likely to develop digitally-enabled integrated solutions than firms with weak resource base.

The extant literature recognizes that digital servitization is a complex process of organisational change in which organisational context is a decisive factor (Vendrell-Herrero *et al.*, 2014; Vendrell-Herrero *et al.*, 2017). Organisational context is determined by external-environmental and internal factors, both of which influence stakeholders' expectations (Guerras and Navas, 2007). Under increasing competitive and changing environmental conditions, organisational commitment expressly stated in long-term plan documents (Delmar and Shane, 2003) can be a useful tool for minimizing the trade-offs between opposing demands while fulfilling long-term stakeholders' expectations (Cunha *et al.*, 2016; Gomes *et al.*, 2015; Hart, 1995; Walton, 1985). As stated above, successful differentiation through integrated solutions is a long-distance race in which business performance can only be measured in the long term (Bustinza *et al.*, 2015; Neely, 2008; Visnjic and Van Looy, 2013). We thus posit that:

H2: Firms with strong commitment are more likely to be able to develop digitally-enabled integrated solutions than firms with weak commitment.

Technology has enabled firms to create systems useful for effectively integrating customers' requirements and developing new product/service business models. These systems have forced firms to redefine their organisational configurations in light of new competitive pressures (Bustinza *et al.,* 2017). Yusuf *et al.* (1999) explain that strategic agility helps organizations to adopt different configurations according to the environmental context, to explore their competitive advantage more successfully while providing updated products and services. Strategic agility thus facilitates selection and adoption of the right configuration at the right time, and provides the speed and accuracy required to enact the necessary operational and strategic change and realize the benefits to be derived from implementing new service business models (Gomes *et al.*, 2011). Strategic agility is a pre-requisite for organisational transformation (Bauer *et al.,* 2016). In the absence of this skill, firms may resort to external partners who can deliver integrated solutions rapidly and precisely. Strategic alliances with external organizations enhance firms' dynamic capability (Lee *et al.*, 2011; Gomes *et al*., 2010) without the need to conduct major internal organisational restructuring. Dynamic capabilities are useful for sensing opportunities and threats, and thus for helping to make timely decisions while changing firms' offerings (Barreto, 2010; Barrales *et al.*, 2013). In the context of development of integrated solutions, strategic alliances come in the form of knowledge-intensive business services (KIBS) collaborative partnerships (Lafuente *et al.,* 2016), which enhance firm agility (Webber and Tarba, 2014; Junni *et al.*, 2015). Based on this reasoning, we expect that, in the absence of internal organisational agility, firms will need to resort to external providers or partners to undertake the integrated solutions. We thus formulate the following hypothesis:

H3: The absence of agility in the firm leads to greater likelihood of developing digitally-enabled integrated solutions through collaborative partnership.

From the set of hypotheses formulated, we derive the model of relationships between the variables presented in Figure 2.

[Insert Figure 2]

Research context, data and variables

Context and data

To understand the importance of this framework for organisational change, we perform a study in the NUTS-2 Veneto region (Italy). This region has a highly competitive manufacturing sector and a growing presence of KIBS firms (Unioncamere Veneto, 2016). The data were collected by our industry partner, Unioncamere del Veneto. Veneto's Chamber of Commerce has a Socioeconomic Research Centre that collects and diffuses statistical and economic information on the region. Small and medium-sized manufacturing enterprises (SMMEs) with more than 5 employees were contacted via Computer-Aided Telephone Interviewing (CATI) using a structured questionnaire. Responses were collected from June to July, 2016. Non-response bias was evaluated through the Podsakoff et al. (2003) procedure, and no significant differences were found between early and later survey respondents. The survey was composed of a set of standard control variables, including size, sector and the level of plant usage, as well as relevant items to measure the dependent and independent variables. Table 1 provides the technical specifications of the sample. The survey included almost 1,500 manufacturing firms. The response rate was above 50%, as the industry partner maintains periodic contact with these companies. Our sample contains 736 usable observations.

[Insert Table 1]

Variables

Integrated solutions is a binary variable that measures whether or not the SMME has adopted digital technologies for developing integrated solutions (Corrocher *et al.*, 2002). According to Table 2, 236 firms (32%) in our sample had implemented this offer. We analysed whether these firms had undertaken the solution in-house or externally. *Alliances* is thus a binary variable that takes a value of 1 when the firm resorts to a partner and 0 when it develops digital solutions in-house. 73 firms of 236 (31%) resorted to partners.

Additionally, we studied the organisational variables related to organisational change in digital servitization—*resources and competencies, commitment* and *agility*—and developed a scale to measure the importance of these three critical dimensions in the context of integrated solution development. *Resources and competencies* is composed of three 1-5 Likert scale items (degree of tangible resources, degree of intangible resources and competencies). *Commitment* is composed of a single 1-5 Likert scale item (degree of commitment to integrated solutions). Finally, *agility* is composed of two 1-5 Likert scale items (speed and accuracy). Analysis of internal consistency and reliability yields appropriate values for these measures. When more than one item is available, we average the items to obtain a value for the corresponding dimension. Table 2 summarizes the statistics for these items, as well as for the control variables.

[Insert Table 2]

Findings and discussion

Method and results

Discrete choice modelling can be applied to the survey data. Logistic regression is especially suited to eliciting firm decision-making. We used logistic regression to estimate whether a

given product-firm encompassed integrated solutions, as well as whether the firm decided to implement these solutions internally or externally. The coefficients estimated were used to support or reject the hypotheses, although their size is not economically relevant. An estimate of the slope or Marginal Effect (M.E.) was used to quantify the economic effect of a particular explanatory variable (Greene, 2012). Moreover, we clustered standard errors by sector, as distinctive industrial specificities may influence the relationships analysed.

The first two columns of Table 3 show the estimated parameters of the relationships between resources and competencies, and commitment to the decision to implement integrated solutions in the firm. Hypothesis 1 proposes that, other things remaining constant, firms with more resources and competencies are more inclined to implement integrated solutions. According to our results, an increase of 1% in the firm's level of resources and competencies increases its likelihood of implementing integrated solutions by 0.071 percentage points. This result is statistically significant at 1%, supporting Hypothesis 1. Furthermore, Hypothesis 2 proposes that, *ceteris paribus*, firms with higher levels of commitment to new technologies are more inclined to implement digital integrated solutions. According to our results an increase of 1% in the firm's commitment increases the firm's likelihood of implementing integrated solutions by 0.041 percentage points. This result is statistically significant at 5%, supporting Hypothesis 2.

The third and fourth columns of Table 3 show the relationship between firm agility and the decision to implement integrated solutions through external collaboration with KIBS partners. This analysis was performed only for the subsample of 236 firms that implemented integrated solutions. Hypothesis 3 proposes that, if the other factors remain constant, more agile firms will be less inclined to develop new solutions through KIBS partnerships. Conversely, absence of agility is directly linked to the need to establish alliances with partners that have the necessary skillset. According to our results, an increase of 1% in the

firm's agility decreases the firm's likelihood of resorting to strategic alliances by 0.062 percentage points. This result is statistically significant at 1%, supporting Hypothesis 3.

[Insert Table 3]

Discussion of the results

The results obtained clarify the role that resources and competencies play in firms' decisions to implement integrated solutions. Servitization requires an extended set of resources and competencies (Windhal *et al.*, 2004) that help firms shape industry forces in a particular (given) product-oriented market. The resource-based view of the firm already explains that some firms produce higher outputs than their competitors because they deploy better routine management and implementation of input flows (Winter, 2000). Firms' resource management creates competencies for better-performing activities, such as "manufacturing a particular product" (Helfat and Peteraf, 2003, p. 999) in a more reliable way than the competitors. Such resources and competencies are imperfectibly mobile across firms and difficult to imitate (Wernerfelt, 1984). Due to the intangible nature of their resources and competencies, services are more difficult to imitate than products (Michel *et al.*, 2003). Our results reinforce these previous studies, as they indicate the critical role of intangible resources in developing integrated solutions supported by the firm's better operational product-service configuration.

Unique resources and core competencies are crucial to achieving competitive advantage as well as commitment (Hart, 1995). Commitment has been at the heart of management debates since Walton (1985) established that commitment is a distinctive approach to people management that differs from mere control. From this point of view, human resource management "constitutes a commitment-oriented model of labour management" (Boxall, 1996, p. 59). But can servitization be interpreted as a commitment-oriented model for managing bundles of products and services?

Wiener (1982, p. 418) defines commitment "as the totality of internalized normative pressures to act in a way that meets organisational interests", and organisational identification as its intermediate determinant. Commitment-oriented models are useful for developing innovation (Selvarajan *et al.*, 2007; Zhou *et al.*, 2013). Our results reinforce these previous studies, particularly in the case of manufacturing firms transitioning to offering integrated solutions.

Finally, agility–as well as firm competencies–is related to overall operating efficiency and superior customer service (Buyukozkan *et al.*, 2008). Firm agility can serve as a decision-making support capability aiding in the evaluation and selection of adequate strategic partners (Gomes *et al.*, 2011). Customer service is critical to reconfiguring the *link channels*–primary customer engagement points–that ultimately enhance the firm's product-service portfolio (Bustinza *et al.*, 2013). Strategic agility thus facilitates make-or-buy decisions concerning process efficiency and supply-demand chain configuration, which are seen as a winning strategy to be adopted by manufacturing firms (Yusuf *et al.*, 1999). Our results not only reinforce the evidence of previous studies (Buyukozkan *et al.*, 2008; Yusuf *et al.*, 1999) for general contexts, but provide the first empirical evidence for the specific context of manufacturing firms choosing a partnership with KIBS. As such, our study pinpoints that manufacturers will develop integrated solutions externally only in the absence of agility capability.

Conclusions

This study draws on the intersection of digital business models, the resource-based view of the firm and strategic agility. Digital business models are challenging, and their implementation requires major organisational change efforts and long-term commitment (Vendrell-Herrero *et al.*, 2017). This study proposes a framework for organisational change

in manufacturing firms that can be extended/adapted to other industries. We argue that a firm's resource base and commitment are essential factors for deploying digital integrated solutions, as they are not available outside the boundaries of the organization (Barrales *et al.*, 2013). This means that firms must not only possess intangible resources and competencies in the form of tacit knowledge but also make their commitment explicit through clearly defined long-term servitization plans (Delmar and Shane, 2003). Commitment is the glue that enables swift, decisive reconfiguration of the organization's resources and competencies to align with its changing environment and long-term goals.

Moreover, our framework adds to the relevance of firm agility (Weber and Tarba, 2014) as a capability that, while essential for developing digital integrated solutions, can be outsourced or developed in partnership with other companies. This finding opens an avenue of research in the extensive literature studying mergers, acquisitions and strategic alliances (Gomes *et al.*, 2011; Gomes *et al.*, 2015) that should analyse the agreements and outcomes between manufacturing firms and external service providers offering capabilities of speed and accuracy (Lafuente *et al.*, 2016).

Our framework shows very clearly that managers must both understand the business environment and be able to implement a strategy that best adapts to new market conditions (Bustinza *et al.*, 2017). This idea is consistent with one of the core elements of the Bible, which suggests that there is a difference between the ability to identify the existence of a new reality and the actual change in behaviour. Our model indicates that a 'change of mind' (*metaniote* in Hebrew) should be followed by a 'change of practice' (*shuvu* in Hebrew). To overcome organisational tensions and conflicts, managers must have a clear mindset that favours the adoption of digital business models. Change of mind is a necessary but not a self-sufficient step. Managers must also change managerial practices, including human resource function, organisational culture, and specific internal processes and procedures.

Our framework was validated with a representative sample of manufacturing firms in the Veneto region (Italy). Like any other context, this region has some specific characteristics that may influence our results. Future studies should thus validate our theoretical framework in other contexts. Similarly, from an empirical perspective, our study can be further developed by adding more periods of time (i.e., longitudinal setting) and more items to our measurements.

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Biographical Notes

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Emanuel Gomes, Ph.D (Coventry University) is a Senior Lecturer (Associate Professor) in International Business and Strategy at the University of Birmingham, Birmingham Business School (UK). His research interest is in the areas of M&A, strategic alliances, firm internationalisation , and product service innovation. He is the author of three books on M&A and strategic alliances and of several articles published in various international refereed journals including the Journal of World Business, International Business Review, Management International Review, International Journal of Human Resource Management, Thunderbird International Business Review, Human Resource Management Review, and International Marketing Review (forthcoming).

Ferran Vendrell-Herrero, Ph.D (Autonomous University of Barcelona) is a Senior Lecturer (Associate Professor) in business economics at the University of Birmingham, UK. His research focuses on the innovation dynamics of business models within creative industries as well the impact of digital technology in organisation of creative businesses. This has led him to analyse recent changes in the business models of multinationals in the music, publishing and media sectors. Across these themes he has made a distinctive contribution through

publications in top academic journals, including the Journal of World Business, International Journal of Production Economics, Technovation and Industrial Marketing Management.

Shlomo Y. Tarba, Ph.D. is Associate Professor in Business Strategy and Head of Department of Strategy & International Business at the Birmingham Business School, University of Birmingham, UK. His research interests include mergers and acquisitions, HRM, strategic agility, and organizational ambidexterity. His research papers are published in journals such as Journal of Management (SAGE), British Journal of Management, Academy of Management Perspectives, California Management Review, Human Resource Management (US, Wiley), International Business Review among others. His recent two co-authored books are A Comprehensive Guide to Mergers & Acquisitions: Managing the Critical Success Factors Across Every Stage of the M&A Process by Pearson & Financial Times Press (2014), and Mergers, Acquisitions, and Strategic Alliances: Understanding The Process by Palgrave Macmillan (2011). Dr. Tarba's consulting experience includes biotech and telecom companies, as well as industry association such as The Israeli Rubber and Plastic Industry Association, and The US – Israel Chamber of Commerce.

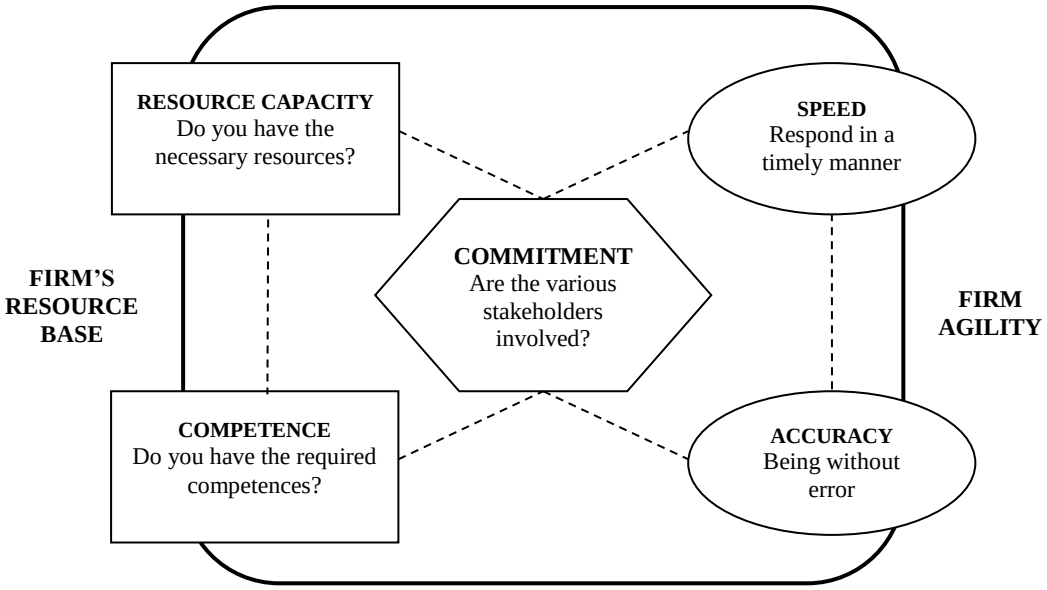

Figure 1. Organizational change through firm's resource base, commitment and agility

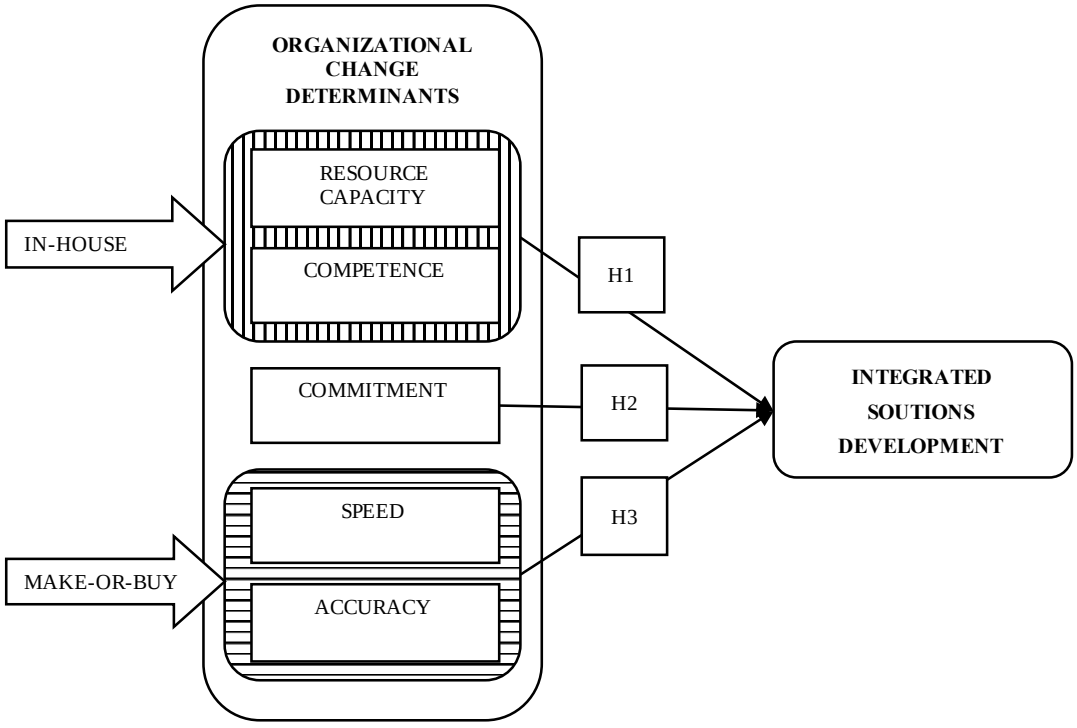

Figure 2. Model of relationships

Table 1: Sample - Technical specifications

Universe	***Small and medium-sized manufacturing enterprises (SMMEs) with more than 5 employees belonging to 11 different sectors***
Source	Unioncamere del Veneto
Geographical area	Settle in Veneto (Italy). Seven provinces reached.
Data collection period	2016 June to July
Methodology	Structured questionnaire
Type of interview	CATI (Computer Aided Telephone Interviewing)
Population	1,423 manufacturing firms
Sample size	N=736
Response rate	51,72%
Confidence level	95 percent
Sampling error (p=q=0.50)	+/- 2.51%
Sample design	Random selection of sampling units
Sector	Metal, machinery, electronics and others (glass, wood, plastic, paper, textile…)

Table 2: Mean values of dependent variables for full sample and other sub-samples

	Full sample (736)	**Solutions** (236)	**In-house** (163)	**Alliances** (73)
Resource & Competences	4.08	4.24	4.27	4.17
Commitment	4.22	4.39	4.40	4.34
Agility	4.30	4.45	4.48	4.37
Plant usage	75.20%	76.00%	76.13%	75.71%
Micro firm	22.01%	15.18%	14.63%	16.43%
Small firm	51.35%	50.22%	50.00%	50.68%
Medium firm	26.63%	34.60%	35.36%	32.87%
Metal	33.15%	23.63%	18.90%	34.25%
Machinery	18.20%	19.41%	20.73%	16.44%
Electronics	10.33%	13.50%	14.63%	10.96%
Other manufacturing	38.32%	43.46%	45.73%	38.35%

Table 3: Logit and marginal effects for integrated Solutions adoption and resorting to alliances with external partners to undertake those solutions.

	Solutions		**Alliances**	
	LOGIT	M.E.	LOGIT	M.E.
Resource & Competences	0.335***	0.071***		
	(0.052)	(0.011)		
Commitment	0.192**	0.041**		
	(0.078)	(0.017)		
Agility			-0.293***	-0.062***
			(0.044)	(0.009)
Small firm	0.508***	0.107***	-0.192	-0.040
	(0.100)	(0.020)	(0.296)	(0.062)
Medium firm	0.94***	0.214***	-0.254	-0.053
	(0.113)	(0.026)	(0.203)	(0.041)
Usage plant	-0.000	-0.000	0.001	0.000
	(0.004)	(0.001)	(0.009)	(0.002)
Machinery	0.552***	0.124***	-0.838***	-0.157***
	(0.019)	(0.004)	(0.084)	(0.014)
Electronics	0.869***	0.203***	-0.904***	-0.164***
	(0.006)	(0.002)	(0.026)	(0.004)
Other Manufacturing	0.670	0.146***	-0.816***	-0.168***
	(0.012)	(0.003)	(0.032)	(0.006)
Constant	-3.922***	--	1.213	--
	(0.203)		(0.949)	
Observations	736		236	
Log likelihood	-437.788		-141.839	
Pseudo-R^2	0.0534		0.0284	
Correctly predicted				
Adopters	62.87%		49.32%	
Non-adopters	60.82%		72.39%	
Total	61.41%		65.25%	

Clustered (by sector) standard Errors in Parentheses. Level of statistical significance: ***, ** and * denote statistically significance of 1%, 5% and 10% respectively. Reference group are micro firms and metal.