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Revisiting IT readiness: an approach for small firms

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Abstract

Purpose – Drawing from the literature, the purpose of this paper is to offer an empirically validated framework for examining information technology (IT) readiness in small firms.

Design/methodology/approach – A conceptual framework of IT readiness for small firms is developed and validated empirically using a quantitative survey of 117 UK manufacturing small firms to identify distinct clusters of firms according to their states of IT readiness.

Findings – The survey responses are grouped according to three distinct profiles that display varying degrees of IT readiness depending upon their strategic motivation, IT processes, project management and technology complexity.

Research limitations/implications – Prior studies examining IT readiness in small-and medium-sized enterprises have not offered a differentiated understanding of small firms that is grounded in quantitative data. The varying profiles of small firms discovered indicate potential paths of IT readiness which offers a basis for further research using longitudinal case studies.

Practical implications – Managerial motivation is not a sufficient condition for achieving IT readiness; it requires both strategic and operational capabilities that have significant implications for training and skills development in small firms. Understanding the level of IT readiness of their organisation can help managers identify areas needing improvement in their use of IT.

Social implications – Findings suggest differentiated policy support is required for various small business clusters identified in the study.

Originality/value – The novelty of the conceptual model differs from the prior literature on IT readiness by explicitly recognising the potential effect of IT maturity on the capability of the firm to respond to opportunities in its external environment. The paper also distinguishes between internal IT processes and project management skills.

Keywords Strategy, Small firms, Project management, Manufacturing, IT readiness, Organizational capability

Paper type Research paper

1. Introduction

While numerous studies attest to a difficult and dichotomous relationship between small firms and (IT) adoption, far fewer studies have explored the role played by IT currently in use by the firm and how this influences further IT use. This is of concern because small firms risk being locked out of increasingly (electronically) integrated supply chains by investing only in basic IT applications and infrastructure (Giannakouris and Smihily, 2013). Some scholars have begun to use the term "IT readiness" to cast new light on how the firm's ability to exploit and derive benefit from their existing technology profile conditions future use (e.g. Iacovou *et al.*, 1995; Haug *et al.*, 2011).

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The construct of IT readiness though lacks agreement, providing the motivation for this paper to determine the constituent factors that make up IT readiness in small firms (Molla *et al.*, 2011). Drawing from the literature, this paper offers a conceptual framework combining elements of previous frameworks but extending into the role played by technology complexity. Empirically, this paper also contributes to the existing literature by eschewing case based research for a quantitative survey of small firms in exploring the validity of the conceptual framework. Indeed, prior studies have not offered a differentiated understanding of IT readiness in small firms that is grounded in quantitative data, as we do through a survey of small manufacturing firms in the UK.

In the following sections, the literature on IT readiness is explored before the conceptual framework, consisting of three domains, is presented and discussed. The empirical methodology used in testing the framework is deliberated before the results of the fieldwork are examined and analysed. Finally the paper concludes with a section that draws on the empirical results and discussion as well as presenting practical implications, possible limitations and future directions.

2. Conceptual development of IT readiness

Reflecting its relative youth, the concept of "readiness" has yet to be consistently defined or applied. "Readiness" for example has been applied at the national, international, and firm level in various different guises such as ecommerce, sustainability and egovernment (e.g. Dutta and Mia, 2011; Chen *et al.*, 2006; Molla *et al.*, 2011; Koh *et al.*, 2008). Molla *et al.*, (2011) points to the "readiness" literature having two distinct viewpoints: as a precursor for change; and as a capability for building, rebuilding and upgrading. In the former, antecedent conditions within the firm in terms of IT infrastructure are thought to impact on the implementation of future change initiatives (Guha *et al.*, 1997). This relates to the drivers and barriers to IT implementation discussed within the IT adoption literature. In the latter, IT supports the firm in renewing capabilities and adapting to changing external conditions (Johnston and Carrico, 1988). This is more reflective of the resource based view which explores capability development and renewal at the firm level. In this paper, the focus is on IT readiness as a capability at the firm level.

The narrower construct of "IT readiness" at the firm level is itself subject to different and varying interpretations, as shown in Table I and none have focused on small firms (i.e. less than 50 employees). For the purposes of this paper, these elements have been organised into three broad areas of attention: strategic, organisational and technological. As Table I indicates, most attention has been paid to developing the strategic and organisational aspects of IT readiness but comparatively little attention has been paid to the firm's IT infrastructure. The term "technological sophistication" is typically used as a proxy for the firm's IT infrastructure, with the implication that greater sophistication denotes higher levels of readiness on the part of the firm. Technological sophistication itself lacks definition and is used in different ways to assess IT readiness. Iacovou *et al.* (1995, p. 469) for example, conflates managerial aspects of familiarity and resources with the running of "highly integrated, computerised processes". Both Johnston and Carrico (1988) and Iacovou *et al.* (1995) implicitly assumed that the firm's capability to respond improves as the IT in use progresses towards greater systems integration. More recently Haug *et al.* (2011) replaced sophistication by internal measures assessing managerial understanding of

	Johnston and Carrico (1988)	Iacovou *et al.* (1995)	Chwelos *et al.* (2001)	Haug *et al.* (2011)
Focus	IS integration	EDI org readiness	EDI	IT readiness
Strategic				
Expected contribution to business goals	X		X	X
Attitude to IT deployment	X	X	X	X
Change pressure	X			X
Organisational				
Financial resources		X	X	
Room for risks				X
Management IT experience	X	X	X	X
Employee IT experience	X	X	X	X
Employee job security				X
IT Project experience				X
Trading partner readiness			X	
Technological				
Current state of IT systems/infrastructure		X		
Definition used	IT is integral to strategy	The availability of the needed organisational resources for adoption	Financial resources and IT sophistication (internal constructs encapsulating organisational readiness), and trading partner readiness (external)	How well a company will adopt a specific kind of IT solution and obtain benefits from this
Approach	Case study	Case studies	Case study	Case studies

Note: X, indicates discussed by the cited literature in the Table

Table I.
Summary of key prior literature

IT. This ignores the role played by IT in fulfilling the firm's strategic motive to respond to opportunity through organisational capability.

Underlying the various conceptions of IT readiness is a focus on the ability of the firm to respond to future events through the integration of the firm's IT with organisational capability. "Readiness" in this sense is a technological capability to exploit opportunities as they present themselves (Chwelos *et al.*, 2001). The balance of attention so far has been on the strategic and organisational context of the firm rather than the technological context.

3. Conceptual framework

Our primary theoretical orientation is that of the resource based view of the firm which stresses the role played by a firm's distinctive capabilities in sustaining competitive advantage (Peteraf, 1993). This view argues that deploying existing internal skills in new ways (innovation) provides the best strategic response to exploiting opportunities.

Firm capabilities are built through the integration of a firm's resources and skills base which are firm specific and path dependent (Penrose, 1959; Wernerfelt, 1984). Such resources display characteristics of being rare, not easily traded (immobile), not easy to copy (non-substitutable) and valuable (Barney, 1991). Organisationally, these resources include human skills through the accumulation of knowledge and expertise and non-human resources such as technology assets, finance, buildings and location (Kay, 1993). Our secondary theoretical orientation is to incorporate insights from the IT maturity literature to introduce into IT readiness a consideration of IT technology infrastructure. This gives attention to the path dependent nature of IT investment and the capability to pursue value creation opportunities. By IT readiness this study explicitly recognises the technological context in the following definition: the capability to pursue value creation opportunities through IT based on a set of strategic, organisational and technological pre-conditions. In the following sections, the key elements making up the strategy, organisation and technology constructs are further discussed in relation to the small firm.

3.1 IT strategy

Effective competitive performance requires congruence between the small firm's strategic goals and IT objectives (Hussin *et al.*, 2002; Chan and Reich, 2011). Small firms have both proactive motivations for IT investment such as new product innovation and more reactive motivations such as competitor behaviour changes, supply chain interventions or new legislation (e.g. Harindranath *et al.*, 2008; Chong *et al.*, 2009; Ifinedo, 2011). Though strategic goals may be contingent on market position, there are growth advantages to deploying IT strategically to increase value adding activities (such as innovation and differentiation) over operational cost efficiency (Wang and Shi, 2011; Levy *et al.*, 2001, 2011). Strategically, the vision and enthusiasm of the owner manager is influential in IT decisions in small firms (Bruque and Moyano, 2007; Parker and Castelman, 2009); their awareness and interest in the strategic possibilities of IT for their business is most important in shaping the investment decision (Grandon and Pearson, 2004; Bayo-Moriones *et al.*, 2013). Not only are owner managers taking an active role in planning and leading IT strategy associated with more sophisticated IT management (Cragg *et al.*, 2013) but their IT knowledge may also form part of the firm's distinctive capability (Chao and Chandra, 2012).

3.2 IT organisation

Bharadwaj (2000) found a positive relationship between IT capability and increases in business value through differentiation, albeit for the large firm. Internal IT expertise is easier to integrate strategically but capability development in a small firm is often managerially ad hoc and reliant on the presence of an employee with an interest in IT rather than as a planned purposeful activity ((Lin and Lee, 2005; Turner *et al.*, 2010). IT investment may also compete with other investment projects because of scarce financial resources, making the evaluation of the returns and benefits of IT investment an important routine within organisational capability (Love and Irani, 2004; Haug *et al.*, 2011). Project management skills help the firm to secure the anticipated benefits from the IT investment and so influence further IT investment (Cragg *et al.*, 2013; Milis and Mercken, 2003); but are frequently missing from the small firm (Maguire *et al.*, 2007). IT capability can be provided within existing supply chains and third party suppliers where small firms lack in house resources (Hicks *et al.*, 2010) although such skills are unlikely to be

distinctive to the firm. However, some internal capability is required for managing the vendor relationship and customisation of the IT bought in (Caldeira and Ward, 2002; Ashurst *et al.*, 2012) and this may be distinctive to the firm.

3.3 Technological complexity

As IT integration moves from stand-alone applications towards integrated firm systems (e.g. ERP), IT investment becomes increasingly incorporated with the firm's strategic planning process (Luftman, 2000). This move towards increasingly complex integration of internal and external systems has long been recognised as strategically valuable and somewhat path dependent (Humphrey, 1988; DTI, 2000; Earl, 2000). A linear development path for IT maturity has been criticised as failing to recognise small firm heterogeneity (Mendo and Fitzgerald, 2005) although a number of e-business maturity models have emerged that matches increasingly integrated applications with greater strategic benefits (Caldeira and Ward, 2003; Oliveira and Martins, 2010; Perego *et al.*, 2011; Barnes *et al.*, 2012). It is this progressive integration of IT infrastructure that the framework refers to as "technological complexity".

4. Methodology

An online questionnaire was submitted to a selected sample of manufacturing small firms in the UK. The questionnaire measured the three constructs of the IT readiness framework: IT strategy, IT process, and technological complexity. The first two constructs were explored by multi-item scales, whereas technological complexity was assessed with a single item. Factor scores of the emerging factors were then used as classifying variables in a cluster analysis to identify groups of firms showing a similar level of IT readiness. Finally, the resulting clusters were also interpreted with respect to descriptive variables.

4.1 Sampling procedure and data collection method

With respect to size, firms with 10-49 employees were considered to be small, in accordance with EU criteria (European Commission, 2003). Active limited companies with a registered UK office were taken from the Financial Analysis Made Easy (FAME) database and drawn from the manufacturing industries which the Department for Business Innovation and Skills (BIS, 2012) define as "medium-high tech manufacturing" (SIC 2007 codes of 20, 21, 26-30). These industries include some of the most dynamic parts of the UK manufacturing sector, where technological innovation plays a major role in achieving a durable and sustainable competitive advantage; for this reason, we chose a survey methodology to profile variations of IT readiness in those firms rather than the case study method deployed in other studies (Table I). The industries include the manufacture of chemical, pharmaceutical, electronic, electrical products and equipment, as well as machinery, motor vehicles and other transport equipment.

An initial sample of 2,107 firms underwent a second sorting to identify as a minimum, only independent small firms with a website (subsidiaries were excluded as outside of this study), leading to a final sample of 1,494 firms. The survey took place between January and March 2013. An e-mail was sent to the firm's contact e-mail (typically the owner manager, identified from FAME or the firm's website), which included a link to the online questionnaire (Surveymonkey.com). Non-response bias was checked by comparing the data collected from each of the three subsequent

reminder mailing rounds with the initial round (Fowler, 1993). One-way ANOVA tests and post-hoc tests found only one difference significant at $p < 0.05$: early respondents generally have stronger strategic aim associated with IT (IT AIMS) than later respondents as might be expected. No significant differences were found for firm age (AGE), and industry (SIC) using Pearson χ^2. Non-response error was therefore assumed as not present (Churchill, 1991).

4.2 Survey instrument

The questionnaire included active variables used in the subsequent factor analysis and descriptive variables used to improve the profiling of the firms in the final cluster solution. Most variables were measured as attitudinal perception items on a five-point Likert scale. Square brackets report variable coding while "§" indicates descriptive variables. A pilot case study and a small scale regional survey of small firms in Italy was used for instrument validation (Spinelli *et al.*, 2013).

Table II groups the variables used according to the IT readiness constructs: "IT Strategy", "IT Organisation" and "Technological Complexity". For most variables, respondents indicated the extent of their agreement – from "completely disagree" (1) to "completely agree" (5). The scale for the variable EXTERNAL OPP ranged from "a necessary evil" (1) to "an opportunity" (5). This was intended to tease out how owner managers perceived the influence of external events in using IT; either as an opportunity to exploit or more negatively as a drain on resources. Owner managers rated the importance of a number of strategic goals (IT AIMS) in influencing their IT investments, from "not important" (1) to "very important" (5). In both cases, we chose to take the highest score among the sub-questions as the overall answer. In our view, it is not relevant how many factors or goals are perceived but rather – consistent with the idea of a strategic, long-term view of IT (Eikebrokk and Olsen, 2007) – whether the owner managers identifies at least one external driver representing an opportunity to exploit through IT and, similarly, at least one strategic goal which could be pursued thanks to IT investments.

The level of IT complexity or application integration in use by the firm was assessed by respondents from a list of IT applications (given in random order with an "Other" option available). A number of studies have used applications sophistication as a proxy for utilisation (e.g. Molla and Licker, 2005; Ghobakhloo *et al.*, 2011a). A final score was calculated by placing the IT applications into five categories of increasing sophistication (APP LEVEL) and giving firms a score (1-5) that matched the rank of the highest class of applications used. We opted for this methodology, instead of a counting method, because we are interested in the highest level of integration achieved rather than the number of applications run by the firm. Table III shows the IT categories.

5. Results

The survey yielded a net response rate of 7.8 per cent (13.3 per cent gross) or 117 firms, comparable with other studies on IT and small-and medium-sized enterprises (SMEs) (e.g. Pickernell *et al.*, 2013). Table IV provides general profiling demographics for the sample, showing that the majority of small firms have been trading for more than ten years and just over half of the sample is engaged in the manufacture of machinery and equipment.

Table V presents the descriptive statistics and correlation matrix for the variables used in this study. This indicates, as expected, that most items related to the associated

Variable	Statement	Sources
Demographic		
AGE	Less than a year; 1-2; 2-5; 5-10; 10+	
SIC	SIC 20; 21; 26; 27; 28; 29, 30	
IT strategy		
PRIORITY	Investing in IT is a priority in my company	Grandon and Pearson (2004)
COMPAWARENESS	I think it is important to be aware of how my competitors are using IT	Eikebrokk and Olsen (2007)
INVOLV	I think it is important for me to be involved in my company's IT decisions	Bruque and Moyano (2007)
ATTITUDE	I have a positive attitude towards IT	Parker and Castelman (2009)
VALUE§	In my company, IT delivers more benefits than costs	Barbara-Sanchez *et al.* (2007)
EXTERNAL OPP	(1) Compliance requirements (2) Suppliers' requirements (3) Customers' requirement	Harindranath *et al.* (2008), Chong *et al.* (2009) and Ifinedo (2011)
IT AIMS	(1) Reduce costs (2) Create new products (3) Acquire new customers (4) Improve customer satisfaction (5) Improve staff satisfaction (6) Facilitate collaboration with other companies	Levy *et al.* (2001) and Ordanini and Rubera (2010)
IT organisation		
AUDIT	We routinely review the returns and benefits of our IT investments	Love and Irani (2004) and Beynon-Davies (2007)
IT EDU	In my company, we place a lot of importance on IT training	Scupola (2009)
PLAN	We have a plan for our future IT investments	Tang *et al.* (2003)
IN-HOUSE ORIGIN§	My company's IT initiatives mainly come from internal staff	Lin and Lee (2005)
IN-HOUSE SKILLS§	My company's IT expertise is mostly in-house	Ashurst *et al.* (2012)
OFFTHESHELF§	My company usually buys off-the-shelf software	Hicks *et al.* (2010)
PM QUAL	In my company, IT projects are generally well managed (e.g. most projects are completed on time and within budget)	Maguire *et al.* 2007 and Haug *et al.* (2011)
BENEF	In my company, IT projects generally deliver the expected benefits	Milis and Mercken (2003)
Technological complexity	See Table III	Caldeira and Ward (2002)

Note: §Indicates descriptive variables

Table II.
Variables used in the survey

IT readiness component show positive and significant correlation to each other. However, this is less straight forward for the items related to the IT organisation component which is discussed in the next section.

5.1 Factor analysis

Factor analysis (principal components) was used to assess whether the number of factors and loadings of items involved in the two main constructs (IT strategy and IT organisation) conform to the proposed model for IT readiness, using the active

Class 1: basic communication system	Class 2: administrative systems	Class 3: core manufacturing systems	Class 4: integrated manufacturing and business systems	Class 5: external systems integration with customers and/or suppliers
Corporate website	Company Intranet General accounting and finance (including payroll) Document management Generate management report e-banking Human resource management (training, recruitment, etc.) Market research Marketing initiatives Order processing and sales recording Social media	Stock control Production planning and control Product design	Customer Relationship Management (CRM) Enterprise Resource Planning	Supply chain management

Source: Adapted from Caldeira and Ward (2002, p. 126)

Table III.
IT categories

Age	*n*	%	SIC Code	*n*	%
< 1 year	1	0.9	20	5	4.3
1-2 years	0	–	21	–	–
2-5 years	5	4.3	26	31	26.5
5-10 years	8	6.8	27	13	11.1
> 10 years	103	88	28	61	52.1
			29	2	1.7
			30	5	4.3

Table IV.
General profiling demographics

variables shown in Table II. One item (COMP AWARENESS) with low communality levels in the first run was dropped from subsequent analysis. The communalities after the second run were all above 0.383. The data set satisfied Bartlett's test for sphericity (χ^2 (45) = 318,573, $p = 0.000$) and the Kaiser-Meyer-Olkin MSA (0.756).

A varimax rotation with Kaiser normalisation was used to minimise the number of items that have high loadings on any given factor. This resulted in three (not the expected two) factors with eigenvalues larger than one and (as suggested by the analysis of correlations in Table V) these partially correspond to the hypothesised constructs (explained variance 61.45 per cent). The varimax-rotated component matrix (Table VI, loadings below 0.4 not shown in the interest of clarity) lists the three-factor structure. Not all the Cronbach (1951) coefficient αs calculated for IT strategy ($\alpha = 0.624$), IT process ($\alpha = 0.754$) and project management ($\alpha = 0.624$) were greater than the 0.7 benchmark suggested by Nunnally (1978), but acceptable in the early stages of research as suggested by Tan and Teo's (2000) cut-off value of 0.6. Two significant cross-loading (> 0.40) are present in the rotated component matrix, for

Table V.
Descriptive statistics and correlation matrix

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. PRIORITY	3.87	1.095	1															
2. COMPAWERENESS	3.58	1.011	0.286**	1														
3. INVOLV	4.58	0.768	0.243**	0.272**	1													
4. ATTITUDE	4.32	0.839	0.477**	0.365**	0.413**	1												
5. VALUE[§]	4.14	0.899	0.368**	0.225*	0.321**	0.615**	1											
6. EXTERNAL OPP	4.09	1.087	0.270**	0.096	0.012	0.168	0.076	1										
7. IT AIMS	4.24	0.827	0.377**	0.214*	0.146	0.421**	0.431**	0.293**	1									
8. AUDIT	3.26	1.133	0.153	0.233*	0.198*	0.344**	0.159	−0.012	0.143	1								
9. IT EDU	3.29	0.956	0.456**	0.234*	0.120	0.365**	0.234*	0.100	0.249**	0.454**	1							
10. PLAN	3.47	1.141	0.345**	0.314**	0.197*	0.442**	0.180	0.099	0.273**	0.556**	0.513**	1						
11. IN-HOUSE ORIGIN[§]	3.65	1.011	0.014	0.015	−0.135	0.115	0.129	0.059	0.122	0.104	0.053	0.062	1					
12. IN-HOUSE SKILLS[§]	3.37	1.208	0.029	0.000	−0.084	0.009	0.120	−0.057	0.075	0.054	0.041	−0.008	0.353**	1				
13. OFFTHESHELF[§]	3.67	1.145	−0.069	0.094	−0.052	0.033	−0.039	−0.018	0.030	0.149	0.058	0.161	0.077	0.021	1			
14. PM QUAL	3.12	1.084	0.049	0.180	0.237*	0.232*	0.240**	−0.023	0.083	0.388**	0.157	0.073	0.015	0.071	−0.141	1		
15. BENEF	3.66	0.921	0.204*	0.234*	0.283**	0.391**	0.359**	0.141	0.108	0.468**	0.192*	0.228*	0.250**	0.176	−0.158	0.534**	1	
16. TECH COMPLEXITY	4.26	0.875	0.135	0.205*	0.128	0.187*	0.140	−0.015	0.329**	0.120	0.144	0.237*	−0.031	−0.060	0.072	−0.043	0.028	1

Notes: [§]Indicates descriptive variables. *,**Pearson correlation (two-tailed) is significant at the 0.05 and 0.01 levels, respectively

	Component		
	IT strategy	IT process	IT project management
PRIORITY	0.674		
ATTITUDE	0.543		0.417
EXTERNAL OPP	0.689		
IT AIM	0.700		
PLAN		0.826	
IT EDU		0.791	
AUDIT		0.715	0.465
INVOLV			0.546
PM QUAL			0.820
BENEF			0.809

Table VI. Rotated component matrix

ATTITUDE and AUDIT but as the loading on the intended factor is far higher, these cross-loadings are acceptable.

The first factor is consistent with the conceptual framework in containing the items related with the owner manager's strategic motivation for IT (IT strategy), apart from the involvement of the owner manager in the company's IT decisions (INVOLV), which loads to another factor. The second and third factors both refer to the IT organisation but from different perspectives: the second factor reflects organisational features which support IT management (IT Process), while the third factor is arguably more strictly connected with IT project management (Project Management), including the involvement of the owner manager. Although only a single IT organisation factor was anticipated in the IT readiness framework, the resulting two factors – IT processes and project management skills – help to clarify that both contribute organisationally to IT readiness in the small firm. Figure 1 illustrates the IT readiness framework as validated empirically.

5.2 Cluster analysis

To identify groups of firms sharing a common profile with respect to the determinants of IT readiness, a k-means cluster analysis was performed, using scores on the IT strategy, process and project management factors and the standardized score of the APP LEVEL variable (obtained from the questionnaire) as input data. Three- to six-cluster k-means solutions all showed significant F-tests ($p < 0.001$) for the four

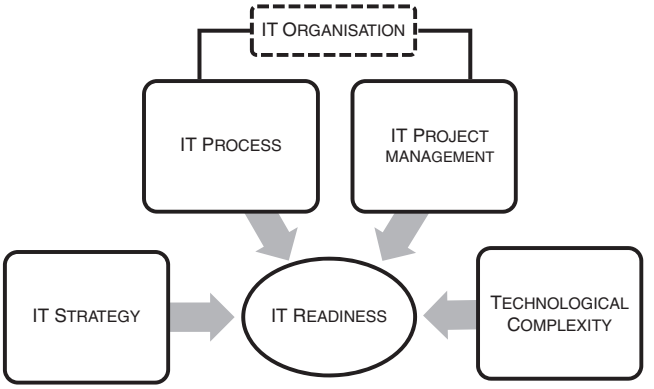

Figure 1. The IT readiness model

variables. A Pseudo-F test showed the highest value for the three-cluster solution, which also returned a cluster structure interpretable and consistent with the theoretical framework (Calinski and Harabasz, 1974). Table VII displays the final centroids and proportions for the three clusters with positive (negative) scores on one specific dimension, such as "Process", indicating higher (lower) than average traits within the clusters. One-way ANOVA tests were conducted to assess significant differences in the mean score of the descriptive variables to additionally profile the three clusters; only VALUE – marked with an asterisk – was found significant at $p < 0.05$. Post-hoc tests (Scheffe, LSD and Bonferroni) found significant the differences between clusters 1 and 2, 2 and 3. No significant differences in the AGE and SIC distribution for the firms in the clusters was found between those variables and the cluster membership (AGE: χ^2 (6) = 4.982, $p = 0.546$; SIC: χ^2 (10) = 7.376, $p = 0.722$) using Pearson χ^2 analysis.

Table VII displays the three clusters of similar profiled firms bounded by the four domains that emerged from the survey. Each cluster represents a distinct set of shared characteristics made up of strategic motivation (IT strategy), organisational capability (IT process), project management experience (IT project management) and technological complexity.

Firms in cluster 1 (29.06 per cent) make the most basic use of IT and has the lowest scores for both strategic motivation and organisational features and an average level of project management capability. These firms or rather the owner managers do not have a strong positive attitude towards their IT investments, nor view IT investment as a priority or possess clear aims for their IT and appear to be uninformed as to how rivals use IT. Organisationally, the firms in this cluster are less engaged in planning and auditing and are less likely to see IT training as a priority. However, the limited IT investments are competently project managed with owner managers involved in decision making. Firms here are somewhat more likely to use off the shelf software. Tellingly, owner managers' perceptions of the capability of IT to deliver more benefits over costs or value-for-money are lowest in this cluster.

The firms summarised in cluster 2 (47.01 per cent) display above average use of IT, and high scores for both strategic motivation and project management. Here, owner managers have higher expectations of benefits from their IT projects and are more confident in the IT skills of their internal staff than in the other clusters. While not statistically significant, these owner managers were the most positive for internally driven IT initiatives and had the lowest preference for off-the-shelf software. These

	Cluster		
	1	2	3
% Proportion	29.06	47.01	23.93
IT strategy	−0.58995	0.37754	−0.025233
IT process	−0.79279	0.24003	0.49118
IT project management	0.06793	0.55657	−1.17575
Technological complexity	−1.24723	0.40948	0.26472
VALUE[§,a]	3.85	4.45	3.86
IN-HOUSE ORIGIN[§]	3.50	3.80	3.54
IN-HOUSE SKILLS[§]	3.47	3.49	3.00
OFFTHESHELF[§]	3.65	3.58	3.86

Table VII.
Final cluster centres

Note: [a]Significant at $p<0.05$. [§]Indicates descriptive variables

firms also perceived themselves as using more complex IT systems and this may be linked to the more positive perception of project management.

Cluster 3 (23.93 per cent) is the least populated of the sample. These firms make high use of IT and perceive themselves as having effective internal processes, but are moderately lacking in strategic motivation and have the poorest score in project management out of all three clusters. However, the owner managers have the strongest positive perception of their firms' capability in auditing IT investments, view training on IT as a business priority and plan for future IT investment. Yet the same managers are the most negative in their perception of IT's capability to deliver more benefits than costs and are personally disconnected from involvement in IT decision making.

6. Discussion

Recently, Cragg *et al.* (2011) argued that SMEs could enhance their economic contribution if they could establish ways of identifying significant gaps that limit their deployment of IT. This study suggests that these inconsistencies, at least for small manufacturing firms in the UK, reflect disparities in the antecedent conditions for IT which can be characterised as differing states of IT readiness. Table VIII summarises the comparative IT readiness profile for each cluster, suggesting the small firms surveyed differed in their capability to derive value from IT investments. Small firms in the "proactive" cluster appear most ready to extract value from IT because they score comparatively highly on three out of the four constructs. In contrast, firms in the "ill-equipped" cluster appear poorly positioned having scored low or very low in three out of the four constructs. Firms in the "constrained" cluster offer the most varied profile having scored highly in two constructs, averagely in one and comparatively very low in the remaining construct.

Firms labelled "ill-equipped" appear less interested in seeking out opportunities to innovate (Hernandez-Pardo *et al.*, 2013) and are less likely to perceive IT as a means to strategic advantage (Perego *et al.*, 2011). Pressure for change is typically mediated externally (Sawang and Unsworth, 2011). Strategic decisions are reactive with investment in discrete, ad hoc applications offering limited strategic value to the firm (Ghobakhloo *et al.*, 2011b). Earlier studies found that the majority of SMEs exhibited low rather than high levels of application complexity (Chibelushi and Costello, 2009). Whereas Higón (2012) observed that innovative firms make both greater use of IT and use more complex IT. A recent survey of German manufacturing SMEs suggested higher performers preferred to buy "tailored solutions for particular problems" whilst avoiding more standardised packages (Wuest and Thoben, 2012, p. 490). The owner managers within the "proactive" cluster perceive their IT investment as a means of gaining strategic advantage in their business environment. However, the emphasis on more complex IT applications may be impacting negatively on organisational

Cluster	IT strategy	IT process	IT project management	Technological complexity
1 Ill-equipped	Low	Low	Average	Very low
2 Proactive	High	Average	High	High
3 Constrained	Average	High	Very low	High

Notes: Cut-off values used to define categories respectively delimitate the 1st (Very low), 2nd (Low), 3rd (Average), 4th (High) and 5th (Very high) quintile of the standardised normal distribution

Table VIII.
IT readiness comparative profiles

capability as planning and training struggle to keep up. Pickernell *et al.* (2013) argues the established firm is likely to seek out external support in this task.

In the "constrained" cluster, owner managers are comparatively less inclined to see IT as a strategic priority but operate complex technology. Such firms are less likely to be actively seeking strategic advice because they may not perceive the need for it (Viljamaa, 2011). They also expressed the most negative perception of their company's internal IT skills and were more positive in using off the shelf software than in other clusters. Deciding to invest in IT is not necessarily dichotomous between using bought in applications and developing internal IT capability as some level of internal capability may be necessary to exploit bought in applications (Hynes, 2013). This dependence on off the shelf software together with the poorly perceived project management skills suggests that "constrained" firms could struggle to differentiate themselves in the business environment (Anderson *et al.*, 2011).

7. Conclusion

This study presents a contingent view of small firms which indicates the differing profiles that materialize as the contexts of strategy, organisational processes, project management and IT investments vary. Conceptually, this paper extends the notion of IT readiness to incorporate the influence of technological complexity on the firm. Empirically, this study not only establishes the validity of combining the key framework elements but also suggested a further refinement in distinguishing between organisational processes and project management skills. In doing so, this study partially addresses Haug *et al.*'s (2011) call for further empirical refinement of the framework of IT readiness. This helped to clarify that IT readiness requires both the building of some internal IT capability and operational skills in project management to meet strategic IT expectations.

The variation in empirical profiles suggests not only does IT readiness in small manufacturing firms differ but that their business, strategic and support needs also diverge. Thus while the single largest cluster of firms perceived themselves as scoring comparatively highly on most of the IT readiness constructs, they also perceived themselves as relatively lacking in process capability. In contrast, the second largest grouping of firms ("Ill-equipped") scored the lowest in almost all areas of IT readiness. Consequently, this study suggests business opportunities for vendors and consultants to offer targeted support for small firms with varying needs as opposed to their often undifferentiated approach to such firms.

This study highlights the critical influence of owner managers on the small firm's IT readiness. Understanding the level of IT readiness of their organisation can help them to identify areas needing improvement in their use of IT. Our findings also show that managerial motivation alone is not sufficient and that IT readiness requires the coming together of strategic and operational capabilities, including project management skills, and technology infrastructure. Small firms, through their owner manager, need to embrace change with regard to involving other stakeholders such as senior managers or greater direct employee involvement to help address IT deficiencies rather than relying (just) on the owner's perception and abilities. This has implications for the training and skill needs of not only the owner manager but also the management and staff of the small firm.

Our findings should be seen in the light of certain limitations. The IT readiness framework presented in this paper consolidates previous conceptual developments whilst introducing the new component of technological complexity. Further conceptual

development could extend the components of the IT readiness framework into areas beyond the scope of this present paper, such as the cost of the technology and industry regulatory norms. Empirically, the methodology incorporated a survey approach which at best captures a snapshot of IT readiness at a point in time. It does not capture the dynamic processes at play in moving from one state of IT readiness to another. The varying profiles discovered indicate potential paths of IT readiness which could be investigated with longitudinal case studies in future research. It should also be noted that the survey was restricted to the medium-high tech manufacturing sector and as such, no strong claims for the generalisability of the findings to other sectors less technologically intensive can be made. Extending the empirical testing of the IT Readiness construct into other sectors is likely to lead to additional comparative insights as well as yielding a higher sample size.

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