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Effect of digital transformation on organisational performance of SMEs: Evidence from the Taiwanese textile industry's web portal

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Effect of digital transformation on organisational performance of SMEs

Evidence from the Taiwanese textile industry's web portal

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Abstract

Purpose – The purpose of this paper is to examine the effect of the pilot implementation of an industry-specific web portal as an IT resource on textile SMEs organisational performance. Using a resource-based perspective, portal delivery functionalities, considered as non-physical IT resources, are analysed using the dimensions of portal usefulness, portal interface, and service-oriented portal functions on SMEs users' perceived outcomes of organisational performance.

Design/methodology/approach – Qualitative and quantitative approaches are used to explore the research hypotheses. Data were collected using field interviews and survey from senior executives of small- and medium-sized enterprises (SMEs) in the Taiwanese textile industry.

Findings – Results indicate that the service-oriented portal function dimension, consisting of portal maintenance service, B2B function, and cloud computing, significantly influences organisational performance. Unexpected findings, such as the negative impact of greater industry benchmark information on perceived SME performance, deserve further investigation.

Research limitations/implications – The study extends the theory and knowledge on the resource-based view and its implications on e-business organisational performance of SMEs. The study also offers findings relevant to the design of portal sites for SME administrators and information service providers. Limitations of the research include a small size and the industry-specific data limiting the generalisability of the findings.

Practical implications – Research results practically serve as informative indicators for policy makers, information service providers, and SMEs executives to evaluate feasible elements for web portal design in traditional industry. Findings from this study may help portal service providers in designing better web portal functionalities for SMEs.

Originality/value – This study contributes to the IT business value literature by identifying the linkages between industry-specific portal delivery functionalities and perceived organisational performance through the examination of portal usefulness, portal interface, and service-oriented portal function for textile SMEs.

Keywords Information services, E-commerce, International business

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1. Introduction

With increasing competition in the global market, firms confront a substantial number of challenges to their business operations. Firms in emerging markets face even more difficult challenges (Jean *et al.*, 2010), which significantly impact small- and medium-sized enterprises (hereafter SMEs) in traditional industries that must adapt to government policy changes. SMEs tend to suffer the most due to the highly turbulent and competitive environment in which they operate (Moreno *et al.*, 2012). In Taiwan, recent trade policy changes, such as the trade liberalisation policy with China (under the Economic Cooperation Framework Agreement), is likely to significantly affect SMEs.

Research indicates that firms that make optimal use of information communication technology (hereafter ICT) can access new market opportunities, gain new knowledge regarding their customers, and improve new product development processes more effectively (Neirotti *et al.*, 2008; Setia *et al.*, 2013). In addition, through the convenience of accessing, communicating, and interacting within or among firms, information technology (hereafter IT) may contribute to organisational impacts (see, among others, Bayo-Moriones *et al.*, 2013; Jean, 2007; Melville *et al.*, 2004). Developing direct access to customers through interactive web portals has thus become the dominant e-business strategy among firms. However, due to the scarcity of resources, e-business implementation in SMEs still remains limited.

Despite the recognition of the importance of e-business implementation in SMEs, the literature on the link between IT and business performance remains inconclusive (Jean, 2007; Kettinger *et al.*, 1994; Liang *et al.*, 2010; Marchand *et al.*, 2002;Wiengarten *et al.*, 2013). For example, Strassman (1997) argues that there is no apparent relationship between IT investments and firm profitability as measured by return on equity and return on assets. Other researchers have also failed to find a direct linkage between an increase in IT investment and business economic performance (Chen, 2012; Lin *et al.*, 2011). Researchers suggest that the research emphasis should shift from IT spending to a better understanding of how information resources, people, and IT practices may lead to effective information use in a firm and drive better business performance (Marchand *et al.*, 2002). Taking a resource-based perspective, researchers have argued that since rival firms can easily duplicate investments in IT, IT spending does not provide any sustained competitive advantage. Rather, it is how firms leverage their investments in IT and create unique IT resources and skills that determine a firm's overall e-business effectiveness (Mata *et al.*, 1995).

Under Bharadwaj's (2000) classification of resources, key IT-based resources comprise of physical IT infrastructure, human IT resources (such as technical and managerial IT skills), and intangible IT-enabled resources (such as functionality, information, and customer orientation). The physical IT infrastructure includes computers, communication technologies, and database systems that can be purchased or duplicated easily by rivals. Researchers contend that physical IT resources are less valuable as a source of competitive advantage (Mata *et al.*, 1995). Competitive advantage is difficult to generate from physical IT resources because of the scarcity of financial resources in SMEs. In this study, we thus focus on the synergistic benefits of non-physical IT resources such as human IT resources and intangible IT-enabled resources. To best capture the quality of information use by traditional industry SMEs, we use several dimensions of non-physical portal resources, which include portal usefulness, portal interface, and service-oriented portal functions. Together, these reflect the best portal delivery functionalities (Kettinger *et al.*, 2013; Zhu, 2004). These portal functionalities range from portal training to portal usage, static industry information to portal operational friendliness, and from portal maintenance

service to cloud computing, tailored to meet traditional industry users' needs. In addition, drawing from the literature, this study employs financial benefits, strategic value, market value, organisational efficiency and effectiveness, and capacity utilisation as indicators of organisational performance (Liang *et al.*, 2010; Lin *et al.*, 2011). Traditional business performance is usually measured by a single profitability measurement, ROA or ROI, which offers a narrow and incomplete picture of organisational performance. Studies in business strategy suggest that, due to the multi-faceted nature of key stakeholders in a business, multidimensional performance measures should be used (Marchand *et al.*, 2002). We thus employ the Balanced Scorecard (BSC), which comprises of four performance dimensions, namely, finance, customer, internal process, and learning and growth (Kaplan and Norton, 1992) that are essential to an organisation's success.

Most studies on the business performance of IT employ case studies or questionnaires, and use multiple theoretical paradigms such as transaction cost theory, agency theory, and the market efficiency perspective. Raphael and Zott (2001, p. 500) argue that, "each theoretical framework has limitations when applied in the context of highly interconnected electronic markets". Given that a firm is embedded in its own micro-economic environment, we use the resource-based perspective as our primary theoretical foundation as our research focus is on the effects of industry-specific portal resources (in terms of portal delivery functionalities) on perceived organisational performance. Moreover, the literature on e-business value for traditional industries is sparse (Bayo-Moriones *et al.*, 2013; Zhu, 2004). Few studies have examined the IT business value for SMEs in traditional industries from a resource-based view (RBV) (Bayo-Moriones *et al.*, 2013; Ghobakhloo *et al.*, 2011). Clearly, there is a need for further review and investigation of the business value of IT for SMEs in traditional industries from a resource-based perspective.

In view of the preceding discussion, the primary purpose of this study is to ascertain the effects of portal usefulness (i.e. human IT resource), portal interface, and service-oriented portal function (i.e. IT-enabled intangibles resources) of industry-specific portal delivery functionalities on SMEs users' organisational performance from a resource-based perspective. This study thus extends the knowledge on RBV theory and SMEs and the effect of industry-specific resource attributes on e-business organisational performance. For practitioners, this research provides insights that are relevant to the design of portal sites for SME managers and information service providers.

2. Theoretical background and hypotheses

2.1 ICT and organisational performance

At present, business competition is driven by the growing market expansion abroad, new customer requirements, and new technological innovation, diffusion, and adoption (Esposito and Evangelista, 2014). The fierce competition in the new business environment has spurred SMEs to consider an online presence, a critical element in SME competitiveness and growth (Loiacono *et al.*, 2002). Many SMEs are launching and maintaining websites to enhance their business. This trend in the business environment places importance on research on the effects of ICT implementation on organisational performance (Bayo-Moriones *et al.*, 2013; Jean, 2007).

Studies show that IT may enhance organisational performance (Brynjolfsson, 1993; Cardona *et al.*, 2013; Gu and Jung, 2013; Kohli and Devaraj, 2003). However, the dimensions and extent of IT business value and the impacts of IT are attributed to various factors such as IT capability, IT resources, IT infrastructure, management practice, and the competitive environment (Bharadwaj, 2000). The unclear

conceptualisation of different IT resources and the sparsely studied effects of IT resources that interact with other capabilities to create competitive advantage (Jean, 2007) also complicate the effects of IT business value. Thus, the linkage between IT and organisational performance still remains unclear.

Even though there is an existence of diverse notions on IT resources, the conceptualisation of IT as identified by scholars is a step toward unification of the diverse accumulated knowledge. According to Melville *et al.* (2004), scholars view IT as an engineered tool that does what its designers intended, as a proxy view defined by individual perceptions of its usefulness, as an ensemble that is the interaction of people and technology in both the development and use of IT, and as an algorithm and systems development and testing. These conceptualisations of IT are visualised as IT capabilities and resources and examined by researchers to explore prevailing assumptions about IT business value. However, the investigation of IT business value is usually operationalised using aggregate variables measured in IT investment, thereby limiting our understanding of the differential effects of various types of IT and the role of IT usage (Devaraj and Kohli, 2003). Furthermore, the role of industry users is often excluded from the analysis, impairing our understanding of industry expertise in generating IT business value.

In this study, we summarise those IT conceptualisations as portal delivery functionalities which include three dimensions such as portal usefulness, portal interface, and service-oriented portal function instead of using an aggregate measurement of IT investment to examine its effects on perceived organisational performance. The first dimension, portal usefulness, is related to the concept of usefulness of IT tools. The second dimension, portal interface, is derived from the ensemble view that focuses on the interaction of people and technology in both the development and use of IT. The third dimension, portal function, is related to the computational view, which may provide a better view of information system development and better data simulation. Additionally, we focus on industry users' needs for the various dimensions of portal delivery functionalities and investigate the relationships between those needs and perceived organisational performance. An understanding of the industry users' preferential portal functionalities may provide portal service providers with useful suggestions for satisfying industry users' needs, which may improve the business value of IT.

Furthermore, IT is identified as a specific resource (Bharadwaj, 2000; Jean, 2007; Mata *et al.*, 1995) that gives sustained competitive advantage, which leads to enhancement of IT business value. Despite the existence of multiple theoretical paradigms that may be employed to link IT to organisational performance, we chose the RBV as the basis for this study. This is because the SMEs in this study use web portal functionalities as a resource to implement "a value creating strategy not simultaneously being implemented by any current or potential competitors" and one that their rivals are not able to duplicate (Barney, 1991, p. 102). The RBV of the firm emphasises heterogeneous firm resource endowments as a basis for competitive advantage. Four conditions- value, rareness, inimitability, and non-substitutability, are necessary for a resource to provide a sustained competitive advantage. In this study, the industry-specific web portal functionalities are heterogeneous firm resource that create value for SMEs and cannot simultaneously be implemented by other competitors, and thus may lead to the development of sustained competitive advantage for SMEs.

2.2 Organisational performance

Many studies conclude that organisations are reflections of the perceptions and actions of their senior executives. In SMEs, business owners or executives have a far greater

potential in predicting organisational performance. In this study, we thus focus on business owners or senior executives as valid indicators of how SMEs perceive portal usefulness, interface, and functions.

Traditionally, the business performance measurement uses a single financial performance measure of profitability such as ROA or ROI. However, studies in business strategy suggest that multiple measures of organisational performance must be used because key stakeholders such as customers, employees, shareholders, business partners, and senior managers all perceive IT differently (Marchand *et al.*, 2002). Thus, executives would not be misled by a single financial measure and make inappropriate strategic decisions.

The textile industry is characterised by intense international competition, especially in countries with trade liberalisation policies, which makes indicators such as quality, efficiency, and innovative capabilities critical for business survival (Gu and Jung, 2013). An analysis of the competitiveness of the European textile sector based on an industrial excellence model that was developed by INSEAD shows that key performance indicators of the textile sector include quality, flexibility, supply chain management, strategy formulation, strategy implementation, human resource management, and knowledge management (Bilalis *et al.*, 2006). In this study, we discuss specific characteristics of SMEs in the textile industry with respect to the effects of portal delivery functionality on perceived organisational performance. According to Gumbus and Lussier (2006), SMEs may benefit from using a BSC approach to measure performance because the BSC approach expands traditional financial indicators by incorporating measures related to customers, operational efficiency, and employee learning and growth (Kaplan and Norton, 2002). These measures are critical in helping SMEs in the textile industry to compete in domestic and global markets. According to our in-depth field study data, an important competitive advantage for textile SMEs in Taiwan should be flexibility in production due to the small scale of their businesses. The internal indicators of operational efficiency and employee learning and growth are critical measures of a firm's production flexibility. Several companies report improvements in operational efficiency and profitability as a result of the use of BSC measures (Gumbus *et al.*, 2003). On the basis of the European textile industrial excellence model developed by INSEAD, quality is also a significant performance indicator for textile firms that wish to compete in global markets. We employ customer satisfaction to evaluate product quality.

The use of high standards for business performance indicators will lead organisations to generate high-quality products and services. These high-standard performance indicators may provide strong incentives for the acceptance of new technology (Del Aguila and Paddilla, 2008). Additionally, according to Kaplan and Norton (2002), organisations that compete in complex environments may require an accurate performance appraisal method for achieving organisational goals. The BSC translates an organisation's mission and strategy into a comprehensive set of performance measures and thus provides an appropriate benchmark framework for producing high-quality products and services on a competitive basis.

2.3 Dimensions of portal delivery functionalities and perceived organisational performance

Although the World Wide Web has become one of the most widely used information technologies, research indicates that many SMEs are yet to adopt web technology

(Beatty *et al.*, 2001). In particular, in traditional industries such as the textile industry, new technology adoption is quite challenging because smaller firms possess limited resources (Lin *et al.*, 2011). The shortage of financial resources, IT knowledge, and the technical expertise to run the websites constrains the adoption of new IT (Mehrtens *et al.*, 2001). The findings of Albors-Garrigos *et al.* (2009) indicate that usability and training for users in ICTs created value in the mature tile ceramics industry and resulted in an increased willingness among firms to accept new technologies. In addition, a web portal is a shareable information delivery base (Bharadwaj, 2000), which emphasises on the reach and range (Keen, 1991) of a portal interface. Keen (1991) define reach as the locations that the website can access and to which it can link, while the range is the variety of information that can be shared across systems and services. Operational factors (such as user friendliness) and the content of information (such as benchmark industry information) in a portal interface are described as major resources that enable SMEs to attain efficiency and competitive advantage (Chen, 2012). Industry users suggest that service-oriented portal functions such as portal maintenance service, business to business (B2B) transactions, and cloud computing capability may also support more effective achievement of organisational objectives in relation to the SME's external environment. The effects of the portal delivery functionalities (i.e. portal usefulness, portal interface, and service-oriented portal function) on perceived organisational performance are discussed below.

2.3.1 Portal usefulness and perceived organisational performance. Training and usage in usefulness. Portal usefulness is defined as the extent to which employees believe that using a particular system (e.g. web portal) will enhance their productivity (Davis *et al.*, 1989; Van der Heijden, 2003). Drawing on the meaning of the definition, the notion of usefulness is related to human IT resources comprising of the technical and managerial IT skills (Bharadwaj, 2000) since employees should be capable of and willing to use the new technology. Previous studies on the use of World Wide Web find empirical support for the relationship between usefulness and usage (Atkinson and Kydd, 1997; Igbaria *et al.*, 1995). By virtue of the actual website usage, experiences will be accumulated over long periods of time (Katz, 1974), which is recognised as organisational human resources from resources-based perspective (Barney, 1991; Grant, 1995). In addition, where SMEs have a shortage of technical expertise in using new technology, sufficient training may enable SMEs' employees to enhance technical skills prior to the implementation of new web portal. The resource-based perspective thus comprises of the IT training of employees as one of the critical organisational human IT resources (Barney, 1991). Ji and Yun (2006) observe that important sources of support for new technology usefulness include training, planning, and execution. In particular, due to the lack of resources, training programs for employees in SMEs are not as robust as those for employees in multinational companies. Most employees in SMEs have to perform multiple job tasks, which makes them reluctant to learn new technologies and skills. Sufficient IT training will reduce barriers and unfamiliarity in using new technology and make users in SMEs to become more willing to use the new technology in their businesses. Training improves users' productivity in the usage of new technology (Theophilus, 2010). Therefore, appropriate IT training and portal usage may play important roles in the development of professional and experienced human resources which constitute heterogeneous resources for SMEs. On the basis of resource-based perspective, we conclude that human IT resources are not easy to obtain and

difficult to imitate. They may serve as sources of competitive advantage. We thus hypothesise:

H1a. The level of portal training for SMEs users is positively related to perceived organisational performance.

H1b. The portal usage is positively related to perceived organisational performance.

2.3.2 Portal interface and perceived organisational performance. Zhu (2004) state that the internet is a new communication channel to reach customers and the web portal serves as a gateway to deal with customers and suppliers through the channel. This new communication channel is characterised by global connectivity, spacious interactivity, and non-restrictive network integration. These characteristics thus offer substantial capabilities in reaching customers and in providing information richness for portal gateways. Similarly, a web portal serves as a shareable information delivery base which emphasises the reach and range (Keen, 1991) of the portal interface. Porter and Millar (1985) also propose that the information provided by portal systems is an essential resource that facilitates a firm's development of competitive advantage.

Operational friendliness. As the internet offers global connectivity and spacious interactivity, a user-friendly gateway may facilitate customer reach. If users perceive or have difficulties in operating a portal interface, these difficulties may have negative effects on new technology implementation (Lin, 2008) and customer reach. Specifically, a user's friendly portal gateway enables a two-way real-time information exchange between SMEs and their customers and suppliers, which strengthens a firm's ability to provide transactional and informational resources to its customers and suppliers across time and space. From the resource-based perspective, the operational friendliness of a web portal cannot only improve the customer reach efficiency, but may also enable acquisition of IT-enabled intangibles (Bharadwaj, 2000) which help in generating competitive advantage for SMEs. We thus hypothesise:

H2a. The operational friendliness of an e-business portal interface is positively related to perceived organisational performance.

Industry benchmark information. As Zhu (2004) contend, web portals which provide useful information about the company and its products and services are the most common dimension in e-business capability. The most common information on web portals includes product information, search, navigation, and store locations. Rather than using company-related information, we postulate that the industry benchmark information should be provided on the industry web portal and would be beneficial to organisational performance. According to Tarafdar and Zhang (2008), information content is the most important website design characteristic for achieving the organisational objectives of increasing website reach and range. The provision of industry benchmark information (such as up-to-date industry information) by a web portal allows SMEs to easily access industry information and to judge their current status against rivals in the industry. This industry benchmark information thus becomes an essential driver of SME progress and improvement. The exploitation of industry benchmark information may then be treated as an idiosyncratic organisational resource (Barney, 1991), which creates value in building capabilities for competitive advantage in SMEs. In a highly competitive industry such as the textile industry, industry benchmark information is essential for SMEs to position themselves

in the global market, and in motivating them to pursue industry leader roles. We thus hypothesise:

H2b. The quality of the industry benchmark information provided in a web portal is positively related to perceived organisational performance.

Bilingual information. Keen (1991) defines information reach as the locations that the website can access and to which it can link, while the range is the variety of information that can be shared across spaces, systems, and services. As a shareable information delivery base on the internet, a web portal seeks to extend its reach and range, which not only facilitates interactions between customers and businesses (Coyle and Thorson, 2001; Lin *et al.*, 2011), but can also expand the geographic scope of a business. To strengthen this two-way information exchange between firms, language barriers must be overcome.

SMEs use the web portal to provide informative material and promotional messages for existing or potential customers. Web portals have become a useful virtual marketplace for SMEs to reach global markets and increase the range of target customers (Simmons *et al.*, 2011). Eid *et al.* (2006) find that bilingual portal information is critical for reaching a wide range target customers. During our in-depth field interviews, several SME managers suggested that exposure to international customers requires e-business portal sites to provide bilingual information. For example, the presence of an English-version interface in the e-business portal helps international customers to access company or product information without language barriers, which promotes expansion of business from domestic to international markets. These market expansion opportunities enhance the performance of SMEs. We conclude that bilingual information is an IT-enabled intangible resource (Bharadwaj, 2000), which is recognised as a key driver of superior organisational performance. Thus, we hypothesise:

H2c. The quality of the bilingual information provided on a web portal is positively related to perceived organisational performance.

2.3.3 Service-oriented portal function and perceived organisational performance. Previous research states that IT enables a firm to improve efficiency (i.e. internal cost reduction and productivity enhancement) and effectiveness (i.e. the achievement of organisational objectives in relation to a firm's external environment) to gain competitive advantage (Melville *et al.*, 2004). In this study, we reviewed the academic literature and interviewed textile industry users about perceived portal functions, summarised as three factors: portal maintenance service, B2B, and cloud computing. These factors may be defined as the "service-oriented portal functions" which contribute not only to a firm's efficiency (e.g. internal cost reduction in portal maintenance and cloud computing) but also to its effectiveness (e.g. B2B function brings more transactions with external partners) in textile SMEs.

Portal maintenance services. IT resources create business value by improving operational efficiencies and creating competitive advantage (Melville *et al.*, 2004). For service-oriented portal functions as IT resources, the source of portal maintenance services provided by portal service providers determines the propensity of SMEs users to adopt new technologies (Beatty *et al.*, 2001). Moreover, SMEs users suggest that portal maintenance service is one of the portal resources they need the most. The maintenance service is related to the service quality provided by portal service providers. The limited financial and technical resources of SMEs prevent them from

having the capability to regularly maintain the web portal and this leads to portal implementation failure. Researchers emphasise the importance of providing high-quality service to increase website success (DeLone and McLean, 1992; Teas, 1994; Zeithaml *et al.*, 1996) and organisational impact (Gorla *et al.*, 2010; Setia *et al.*, 2013). Additionally, the service quality is defined as a consumer's overall impression of the relative inferiority or superiority of a provided service (Zeithaml, 1988). The most influential conceptualization of service quality is the five dimension model proposed by Parasuraman *et al.* (1988), which includes tangibility, reliability, responsiveness, assurance, and empathy. The SERVQUAL instrument has become the most popular measure of service quality (Zeithaml, 2000) and is a reliable predictor of overall service quality (Bitner and Hubbert, 1994). In this study, we used only four scale items for service quality, including reliability, responsiveness, assurance, and empathy (Pitt *et al.*, 1995). We dropped the "tangible" item from Parasuraman *et al.* (1988) due to the suitability of these four items for information systems. Reliability measures the extent to which the portal service provider strives to improve the information services provided to users. Responsiveness indicates the extent to which the portal service providers are willing to help users and provide prompt service. Assurance is the ability of the portal service provider to build users' confidence. Finally, empathy indicates the personal attention and care provided by the portal service providers. We thus hypothesise:

H3a. The quality of the portal maintenance service provided by the web portal service provider is positively related to perceived organisational performance.

B2B. With increasing competition in global markets, the management of international customer-supplier relationship has become increasingly important. The implementation of a B2B web portal is seen as an important strategy for enhancing SME effectiveness (Lin *et al.*, 2011) by improving communication and interaction and increasing visibility and accessibility with stakeholders (Ellinger *et al.*, 2003). Suppliers such as Taiwanese textile businesses are more dependent on international customers for survival due to a limited domestic market. In addition, the limited physical distribution channels across global markets create difficulties for SMEs in Taiwan in reaching international customers (Jean *et al.*, 2010). Web-based portals, which act like a gateway for business clients to reach desired internet locations or potential targets, represent key marketplaces for business marketers to access, communicate, and transact with external partners (Clarke and Flaherty, 2003). The B2B portal function thus becomes an organisational resource used by SMEs to improve their marketing and transactions (Fazlollahtabar, 2012; Lin *et al.*, 2011) with external partners. We thus hypothesise:

H3b. The quality of B2B portal functions is positively related to perceived organisational performance.

Cloud computing. Cloud computing refers to the storage and management of data on virtualised servers and provides organisations with the ability to connect to data and computing resources anytime and anywhere (Greengard, 2010). The emergence of cloud computing technology has created great changes for entrepreneurs and businesses (Greengard, 2010). This new technology is a modern and complicated research concept which is still in its infancy (Marston *et al.*, 2011; Trigueros-Preciado *et al.*, 2013). Cloud computing represents a quick and affordable method of connecting with IT resources. Businesses can access large-scale remote resources in a timely

manner through cloud computing. This new technology offers an opportunity to create new types of businesses and new markets, such as e-commerce for the mobile phone user market. Apart from access to better resources, Trigueros-Preciado *et al.* (2013) argue that the use of cloud computing is beneficial for cost reduction, accessibility, and flexibility. SME users do not have to make substantial investments in computing resources for the portal system, thereby leading to cost reduction. Thus, the entire IT system can be managed through a simple web portal that allows spacious and flexible access. These benefits may boost SME business efficiency and effectiveness, leading to competitive advantage. We thus hypothesise:

H3c. The quality of cloud computing function of an e-business portal is positively related to organisational performance.

2.3.4 Moderating effect. After the implementation of a new web portal, non-professional IT users in SMEs have to perform more and more basic tasks via information system. SMEs managers and information service providers have to make sure those SME users learn how to use the web portal effectively. Previous research suggests that to develop an appropriate training programme and to utilise user-friendly interface are two complementary approaches for realizing the objective (Davis and Bostrom, 1993). Owing to the unfamiliarity to information systems or the difficulty in applying IT knowledge to a specific task (Carroll and Mazur, 1986) for SMEs' users, many trainees may be frustrated by the complexity of the new technology and be confused about how to recover from errors. By using assimilation theory (Ausubel, 1968), an appropriate training programme may enhance end-user efficiency and effectiveness (White and Christy, 1987) and reduce end-users' learning difficulties. Another equally important factor is the IT interface itself. The IT interface can affect a system's perceived ease of use. The basic notions of IT interface design can be distinguished as being user-friendly (easy to learn and use) or frustrating (confusing interface). For novice IT users, perceptions of the ease of using a system may reduce end-users' learning difficulties and enhance their learning performance. The training outcomes include the perceived ease of system use and task learning performance (Davis and Bostrom, 1993). The assimilation theory also suggests that there may exist a combined learning effect between the IT interface and training approach. We thus propose that portal training and portal interface (e.g. operational friendliness) will interdependently affect one another and hypothesise the interaction effect as:

H4. The level of portal training will enhance the effect of the operational friendliness of a portal interface on perceived organisational performance.

On the bases of the hypotheses, our research framework is shown in Figure 1.

3. Methodology

3.1 Data collection

The sample for this study is drawn from textile SMEs[1] which are members of the textile industry-specific web portal (http://ict.textiles.org.tw). This textile web portal was founded in 2010 and funded by the Small- and Medium-Enterprise Administration (SMEA) of Taiwan's Ministry of Economic Affairs. This portal site, a B2B-based website, is designed not only for extending the networking capabilities of SMEs, but also for providing greater accessibility for industry information. Most textile SMEs are

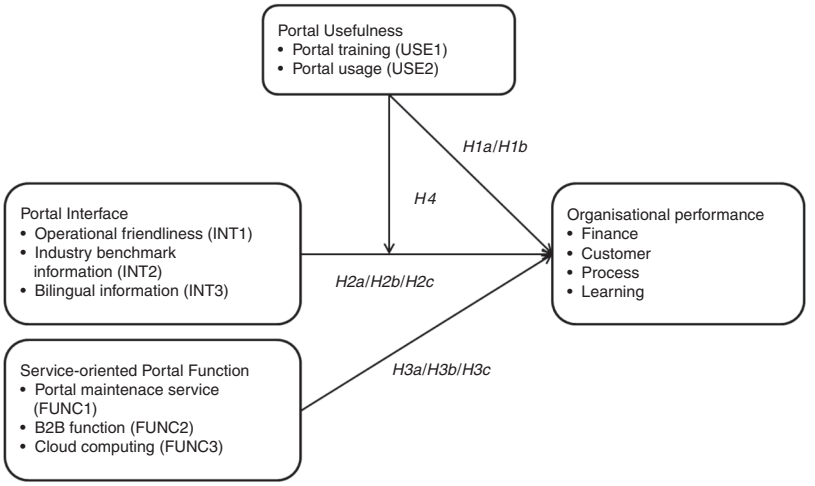

Figure 1.
Research framework illustration

encouraged to participate in this industry-specific web portal. The purpose of this web portal is to engage SMEs in the wave of digital transformation and e-business in order to enhance the competitive advantage of this traditional industry under intense global market competition. By virtue of strong promotion from the SMEA, 753 SMEs are members of this web portal and intend to use the new technology. We thus explore effects of the portal delivery functionalities on organisational performance using this textile industry-specific web portal.

Data of this study were collected in 2010, when this industry-specific web portal was implemented. To ensure data diversity, we categorise the textile industry into four different clusters: towels, hosiery, weaving, and general textile (Table I). Prior to the scale survey, eight in-depth field interviews with textile SME executives were conducted. The main purpose of the field interviews was the collection of practical experiences of and improvement issues for this new web portal from the industry user perspective. The questionnaire was designed using both theoretical views and the in-depth interview responses. A pilot study was also conducted to evaluate the initial questionnaire design.

3.1.1 In-depth field interviews. The in-depth field interviews were conducted with textile SME owners or senior executives from eight different firms. Since the industry

Industry cluster	Firm	Firm asset (N.T.$)	Respondent
Towel	A	6 million	General manager
	B	6 million	General manager
Hosiery	C	5 million	Marketing manager
	D	60 million	General manager
Weaving	E	60 million	Sales manager
	F	60 million	Sales manager
General textile	G	5 million	Sales manager
	H	20 million	Sales manager

Note: Resource from our field interview study

Table I.
The composition of firms with which field interviews were conducted

has four different clusters, we chose two member firms for each cluster. Respondents were chosen on the basis of project involvement, firm size, and product types. Interview questions are designed using dimensions of portal usefulness, portal interface, and portal function, as well as perceived organisational performance. Data collected from field interviews was incorporated into measurement items in the survey questions.

3.1.2 Questionnaire survey. We used the questionnaire to verify our research hypotheses. Employing the survey method of Dillman (1978), we mailed questionnaires to 566[2] SMEs who were members of the portal and followed up with phone calls. Most traditional SMEs still use older communication methods (such as via fax machine or e-mail) when communicating with their external partners, and had only just started using the industry's new web portal. Only 56 surveys were returned, a response rate of 9.9 per cent. Out of those 56 respondents, nine were discarded because they contained missing or incomplete values. Our research results are thus based on a final sample of 46 firms.

3.2 Non-response bias

We next checked for non-response bias by employing the sample mean comparison. We compared respondents and non-respondents based on firm size, measured in terms of total assets. A *t*-test showed no significant difference between the groups, thereby minimising our concerns about non-response bias.

3.3 Common method bias

All data in this study were collected using a single questionnaire, which may lead to common method bias. Harman's one-factor test was used to address this problem (Podsakoff *et al.*, 2003). A principal component analysis of all items that are included in this study was performed. No dominant factor emerged. Thus, there is no evidence for the presence of common method bias in this study.

3.4 Primary measures

By employing results from the in-depth field interviews and theoretical arguments discussed above, we used three dimensions to serve as indicators for measuring the industry-specific portal delivery functionalities. These three dimensions included eight variables that were extracted via exploratory factor analysis (EFA) and principal component factor analysis (PCA).

The major dimensions that we used in this study include portal usefulness, portal interface, and service-oriented portal functions (see Table II). The perceived organisational performance was measured by the four dimensions of the BSC: finance, customer, process, and learning. After conducting the EFA and the PCA, we identified eight variables: portal training, portal usefulness, operational friendliness, industry benchmark information, bilingual information, portal maintenance service, B2B, and cloud computing. We tested our research model using hierarchical regression analysis.

3.4.1 Dependent variable. We measured perceived organisational performance using the four dimensions of the BSC (Kaplan and Norton, 2002) which attempts to complement traditional financial measures with three additional dimensions. These four dimensions are finance, customer, process, and learning. The measurement items that we employed for these four dimensions were taken from Hvolby and Thorstenson (2001) whose research used these items to investigate manufacturing SMEs. We modified these items based on the responses from in-depth interviews.

Dimensions	Variables
Portal usefulness	Portal training (USE1)
	Portal usage (USE2)
Portal interface	Operational friendliness (INT1)
	Industry benchmark information (INT2)
	Bilingual information (INT3)
Service-oriented portal function	Portal maintenance service (FUNC1)
	B2B function (FUNC2)
	Cloud computing (FUNC3)
Organisational performance	Finance
	Customer
	Process
	Learning

Table II. Dimensions and variable of primary measures

3.4.2 Independent variables. In this study, we conducted an EFA to reduce the number of construct variables from our self-reported measurement items. For each item, respondents were asked to indicate the degree of satisfaction for the current industry-specific portal functionalities performed on a five-point scale that ranged from 1 (poorly) to 5 (very much). On the basis of our analysis, three dimensions with eight variables were employed as predictors in our research model. These predictors include the following dimension of portal usefulness: portal training (USE1) and portal usage (USE2), dimension of interface: operational friendliness (INT1), industry benchmark information (INT2), and bilingual information (INT3), and service-oriented functions: portal maintenance service (FUNC1), B2B function (FUNC2), and cloud computing (FUNC3), representing the portal delivery functionalities of this industry-specific web portal. The multicolineality problem for these predictors have been tested and found no multicolineality problem since VIF values are less than ten (Wooldridge, 2012). These variables[3] were developed to evaluate the primary and moderating effects in our research model.

3.4.3 Control variables. Melville *et al.* (2004) observed that firm characteristics such as size, financial condition, age, and worker composition may be complementary to IT. Research also shows that coordination and communication via ICTs is becoming more challenging due to the asymmetrical power relationships of SMEs (Moreno *et al.*, 2012). Cho (2006) also stated that large firms possess more IT resources and are capable of building their own internal IT systems. These firms perceive less benefit from a third-party B2B web portal. We thus used firm size (measured by the number of employees) and firm age (measured by the number of years the firm has been in operation) as control variables.

3.5 Model

$$\mathrm{PERF} = \beta_0 + \beta_1 \mathrm{SIZE} + \beta_2 \mathrm{YEAR} + \beta_3 \mathrm{USE1} + \beta_4 \mathrm{USE2} + \beta_5 \mathrm{INT1} + \beta_6 \mathrm{INT2} + \beta_7 \mathrm{INT3} + \beta_8 \mathrm{FUNC1} + \beta_9 \mathrm{FUNC2} + \beta_{10} \mathrm{FUNC3} + \beta_{11} \mathrm{USE1} \times \mathrm{INT1} + \varepsilon$$

PERF, perceived organisational performance; SIZE, firm size; YEAR, firm age.

Portal usefulness: USE1, portal training; USE2, portal usage.

Portal interface: INT1, operational friendliness; INT2, industry benchmark information; INT3, bilingual information.

Service-oriented portal function: FUNC1, portal maintenance service; FUNC2, B2B function; FUNC3, cloud computing.

4. Results

4.1 Data analysis

The testing of the proposed hypotheses was completed in several steps. First, the reliability and construct validity of the independent and dependent constructs were evaluated using Cronbach's α and factor analyses. For all multiple-item scales, the α-coefficient of each set of items was computed to assess the reliability of the measures. All scales present acceptable reliability values, above 0.7 (Table III), as suggested by DeVellis (2003). Factor analyses assisted in identifying the structure of relationships among items (Hair *et al.*, 1998) and construct validity. Standardized item loadings should be greater than 0.5 (Hildenbrant, 1987). Measured items with loading values of less than 0.5 were removed. We tested construct validity by measuring the strength of the associations between items. The item-to-total correlations are 0.6 or higher within the same construct (Bagozzi and Yi, 1994). If the items were related to different constructs, then the loadings of those items should be less than 0.4. The item-total correlation represents the convergent and discriminant validities of our constructs (Table IV). Second, after reliability and construct validity were established, factor scores were used to reflect the dimensions of the underlying constructs and to test our hypotheses using multiple regression analysis. On the basis of the factor scores used in the analysis, the mean and standard deviation values were 0 and 1, respectively (Table V). Finally, the moderating effects were tested. Descriptive statistics of the respondents are summarised in Table IV. Our average sample firm has 61 employees and the average firm age is 29 years.

Factor/scale	Cronbach's α
Portal usability	0.92
Portal interface	0.81
Portal function	0.98
Performance-finance	0.99
Performance-customer	0.99
Performance-process	0.99
Performance-learning	0.99

Table III. Scale reliability

Item stems	Factor loading	
Frequency of use		0.81
Willingness to use		0.86
Convenience of use		0.75
ICT training	0.90	
Understandability of training content	0.95	
Sufficiency of training content	0.87	
Helpfulness in practical IT usage of training content	0.86	

Table IV. Factor analysis of the dimension of usefulness item stems

Table V.
Descriptive statistics and correlations between variables

Variable	*M*	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Finance	0.00	1.00	1													
2. Customer	0.00	1.00	0.88**	1												
3. Process	0.00	1.00	0.85**	0.93**	1											
4. Learning	0.00	1.00	0.87**	0.90**	0.96**	1										
5. USE1	0.00	1.00	0.40**	0.51**	0.41**	0.40**	1									
6. USE2	0.00	1.00	0.19	0.22	0.34*	0.28	0.00	1								
7. INT1	0.00	1.00	0.38**	0.48**	0.52**	0.49**	0.50**	0.38**	1							
8. INT2	0.00	1.00	0.22	0.23	0.14	0.11	0.34*	0.22	0.00	1						
9. INT3	0.00	1.00	−0.03	0.03	0.05	0.07	−0.07	0.18	0.00	0.00	1					
10. FUNC1	0.00	1.00	0.33*	0.42**	0.38**	0.34*	0.44**	0.23	0.77**	0.21	0.17	1				
11. FUNC2	0.00	1.00	0.49**	0.50**	0.59**	0.53**	0.25	0.28	0.23	0.41**	−0.07	0.00	1			
12. FUNC3	0.00	1.00	0.26	0.28	0.14	0.17	0.39**	−0.09	−0.05	0.43**	−0.23	0.00	0.00	1		
13. No. of employees	61.28	129.39	0.09	0.10	−0.07	0.07	0.28	−0.09	0.11	0.07	0.15	0.17	−0.27	0.45**	1	
14. Firm age	29.09	9.15	−0.02	0.14	0.10	0.15	0.13	0.04	0.12	−0.00	0.12	0.02	−0.09	0.24	0.31*	1

Notes: $n = 46$. *$p < 0.05$; **$p < 0.01$

4.2 Hypotheses tests

We used hierarchical regression analyses to test our hypotheses. Each analysis is tested using the four dimensions (finance, customer, process, and learning) of perceived organisational performance. We first tested the control variables as a baseline model, followed by the independent variables in Model 1, and the interaction variables in Model 2 (Table VI). The incremental R^2 values are shown. Based on the aggregated data in Table VI, results show that a detailed analysis was conducted on those four dimensions of perceived organisational performance. The analysis of the control variables indicates that there is no correlation between the control variables and organisational performance. With regard to the primary effect of Model 1, values of the four performance dimensions show dramatic changes in R^2 (46, 59, 65, and 57 per cent) when testing all independent variables. Hence, the independent variables sufficiently account for the variances in the dependent variables. The results of Model 2 (Table VI) also show significant results for the interaction effects.

4.2.1 Primary effect test results. In this study, we posited that the eight variables of three dimensions, portal usefulness, portal interface, and portal function, are positively related to organisational performance. In addition, we hypothesised that portal usefulness may enhance the relationship between portal interface and performance. Table VI indicates that the three variables of service-oriented portal function have the most significant results. These three variables include portal maintenance service (FUNC1) ($\beta = 0.51$, $p < 0.1$), B2B function (FUNC2) ($\beta = 0.65$, $p < 0.01$), and cloud computing (FUNC3) ($\beta = 0.35$, $p < 0.1$), and results of the test demonstrate significant positive effects on the four dimensions of organisational performance. *H3a*, *H3b*, and *H3c* are supported. Furthermore, for the industry benchmark information (INT2) of the portal interface, the results ($\beta = -0.36$, $p < 0.1$) are negative and significant, contrary to our hypothesis. *H2b* is partially supported. In Table VI, the results show that variables of training (USE1), usage (USE2), operational friendliness (INT1), and bilingual information (INT3) have no significant direct relationship with organisational performance. *H1a*, *H1b*, *H2a*, and *H2c* are thus not supported.

4.2.2 Moderation effect test result. An analysis of the moderating effects of portal training revealed negative and significant effects on operational friendliness of portal interface, results which partially support our moderating hypothesis. Table VI shows that portal training (USE1) negatively moderates the relationship between operational friendliness (INT1) and all four dimensions of organisational performance: finance ($\beta = -0.41$, $p < 0.01$), customer ($\beta = -0.24$, $p < 0.05$), process ($\beta = -0.22$, $p < 0.1$), and learning ($\beta = -0.27$, $p < 0.05$). *H4* was supported, but with a negative moderating effect. This result explains that the greater level of portal training attenuates the effect of the operational friendliness on perceived organisational performance. Followed by the significance testing of moderating effects, we tested the moderating slope (Table VII). As demonstrated by the data in Table VII and Figure 2, the operational friendliness (INT1) improves dimensions of customer and learning performance at a faster rate for firms with low level of portal training (USE1) than for those with high level of portal training.

5. Discussion

This study presents a model of industry-specific portal delivery functionalities that examines the effects of portal usefulness, portal interface, and service-oriented portal functions on organisational performance. The model is empirically tested on SMEs in the Taiwanese textile industry. The statistical results indicate a strong and positive

Table VI.
Results of regression analysis for organisational performance

Variables/models	Finance		Customer		Process		Learning	
	*M*1 (Primary)	*M*2 (Interaction)	*M*1 (Primary)	*M*2 (Interaction)	*M*1 (Primary)	*M*2 (Interaction)	*M*1 (Primary)	*M*2 (Interaction)
Portal training (USE1)	0.10	0.19	0.19	0.16	0.14	0.13	0.13	0.15
Portal usage (USE2)	0.09	0.30*	0.09	0.19	0.19	0.30**	0.14	0.27*
Operation friendliness (INT1)	−0.23	−0.67**	−0.20	−0.35	−0.13	−0.32	−0.09	−0.32
Benchmark info (INT2)	−0.36*	−0.55***	−0.38**	−0.47**	−0.48***	−0.57***	−0.46**	−0.60***
Bilingual info (INT3)	−0.01	0.03	0.05	0.05	0.08	0.07	0.09	0.15
Portal maintenance service (FUNC1)	0.51*	0.82***	0.55**	0.75***	0.48**	0.67***	0.40*	0.60**
B2B (FUNC2)	0.65***	0.73***	0.63***	0.68***	0.70***	0.75***	0.68***	0.72***
Cloud computing (FUNC3)	0.35*	0.65***	0.36**	0.48**	0.35**	0.47**	0.31*	0.51**
Control variable								
Employee number	0.00	0.00	0.00	0.00	−0.00	−0.00	0.00	0.00
Firm age	−0.01	−0.01	0.01	0.01	0.01	0.01	0.01	0.01
USE1 × INT1		−0.41***		−0.24**		−0.22*		−0.27**
Change in R^2	0.46***	0.64***	0.59***	0.71***	0.65***	0.73***	0.57***	0.64***
R^2	0.48	0.65	0.59	0.71	0.65	0.73	0.57	0.64
Adjusted R^2	0.33	0.49	0.47	0.57	0.55	0.61	0.44	0.47
F (df)	3.17 (10)***	4.14 (14)***	5.05 (10)***	5.32 (14)***	6.57 (10)***	6.03 (14)***	4.55 (10)***	3.85 (14)***

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

relationship between portal functions (includes the three variables of portal maintenance service, B2B, and cloud computing) and perceived organisational performance. This finding provides general support for the argument that SME users may support service-oriented portal functions as their IT-enabled intangible resources which contribute to improved efficiency and effectiveness. As we expected, for SMEs constrained by their lack of resources, the service-oriented functions of a web portal outweigh its other functions (such as speed or system capacity). SME efficiency is enhanced by cost reductions in portal maintenance service and cloud computing, and its effectiveness is also derived from the B2B function which may bring more transactions for SMEs in dealing with external partners. These findings are in line with those of Bharadwaj (2000) and Melville *et al.* (2004) who state that IT resources are valuable in reducing costs or increasing revenues for firms, which creates competitive values. From the resource-based perspective, the firm-specific competitive values in cost reduction and revenue increase possessed by SMEs serve as heterogeneous, imperfectly mobility resources to support sustainable competitive advantage (Barney, 1991).

For the dimensions of portal interface and portal usefulness, we proposed that the effects are positively related to perceived organisational performance. However, the findings on the relationship between industry benchmark information and perceived organisational performance which shows negative effects across all four performance

Hypotheses	Moderator (Mo) and independent variable (X)	*b1* (coef.) of *CVz*	Finance	Customer	Process	Learning
H4	Mo: Training (USE1) X: Operational friendliness (INT1)	*CVz_H*	0.14 (0.78)	0.28 (1.62)	0.41 (2.37)**	0.34 (1.91)*
		CVz_L	0.34 (1.82)*	0.34 (1.96)**	0.43 (2.44)**	0.43 (2.35)**

Notes: *CVz*, the conditional value of the moderator. *$p < 0.1$; **$p < 0.05$

Table VII.
Significance results of the moderator slope test

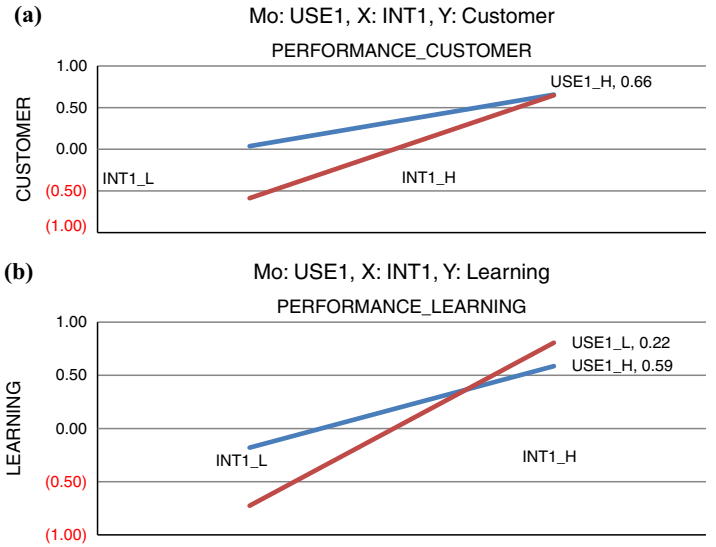

Figure 2.
Moderating effect test for *H4*

dimensions (finance, customer, process, and learning) were unexpected. In this study, the industry benchmark information indicates the abundance of textile industry and leading firms' information provided on the industry-specific web portal. We speculate that the negative result could be explained by the release of excessive industry benchmark information on the web portal, which leads to greater competition between firms. The demand for e-business makes buyers and sellers use the web portal more frequently as a tool to make buying or selling decisions and conduct business transactions (DeLone and McLean, 2003). The release of large amounts of industry benchmark information on a web portal may provide buyers and sellers with additional alternatives when making business decisions. SMEs would then become even more vulnerable under such competitive conditions. The perceived disadvantage from greater industry benchmark information on the web portal outweighs the perceived advantages of it for SME users. Thus, the perceived business value becomes negative.

Additionally, the findings of the Primary Model (Model 1) for portal training and of operational friendliness and bilingual information in relation to business performance in *H1a*, *H2a*, and *H2c* are unexpected and do not meet our prediction. Neither does the finding of the relationship between portal usage and business performance in *H1b* meet our prediction. Another noteworthy finding is that portal training attenuates the relationship between operational friendliness and organisational performance. Similarly, the results of the moderating slope test show that portal training has a negative moderating effect on operational friendliness. This negative moderating effect is in contrast with our prediction. Portal training plays an important role since novice SME users are non-professional computer users who possess little knowledge of new technology. The inappropriate and ineffective training may be blamed and result in the impression of over-complexity on portal interface. Inappropriate training programs (e.g. the complexity of training materials) may lead to a negative impact on the relationship between operational friendliness and performance. Amoako-Gyampah and Salam (2004) suggest that training influences user perceptions regarding ease of use during the early stages of learning and that the perceived ease of use affects usage and acceptance intentions. We speculate that SME users may perceive a high degree of difficulty in using the web portal when portal service providers offer inappropriate training programs. While providing training programs for novice IT users, portal service providers should check more background information about these IT users and offer appropriate training programs tailored to their needs.

6. Conclusion

This study contributes to the IT business value literature by assessing the linkages between portal usefulness, portal interface, service-oriented portal function, and perceived organisational performance in the context of Taiwanese textile industry SMEs using in-depth interviews and a survey-based research methodology. Taking a resource-based perspective, this study developed and investigated a model connecting these dimensions. The study found support for the positive and significant performance outcomes of service-oriented portal functions, as well as the negative moderating role of portal training on portal interface. Service-oriented portal functions, comprising of portal maintenance, B2B function, and cloud computing, serve as essential non-physical IT resources for textile firms. This study thus fills a gap between theory and practice for industry-specific IT resources for SMEs.

The implications of this study must be considered in light of its limitations, which may stimulate further research. First, considering the complexity of IT resources,

thorough and detailed measures of the variables need to be developed. Second, the complex relationship between portal human IT resources (i.e. portal training and portal usage) and organisational performance deserves further study. The negative moderating effect of portal training on the relationship between operational friendliness and performance, the direction of which was found to be contrary to our prediction, needs further investigation. The assimilation theory has been employed to predict the impact of portal training on IT interfaces. And, although previous study points out that basic and advanced training is one of the integral elements of IT designed to improve efficiency and effectiveness, the empirical result from this study indicates that the appropriate training programme is more than necessary. This finding may be ascribed to the unfamiliarity with the new technology non-professional nature of most SMEs' users, who may feel frustrated with the complexity of training programs or materials. However, owing to the relatively small scale of this study, the unexpected finding may deserve further investigation to validate the study results. Third, with regard to the pilot implementation of industry-specific web portals, most member firms are still hesitant in the use of new technology. The research has been conducted at a time when firms are in the early stages of new technology implementation, due to which the research faced a low response rate and a relatively small size, which limits the capacity to generalise the research findings. Fourth, by virtue of the global nature of the textile industry, future research may consider including data from other nations. Finally, the generalisability of the research findings to other industries may need additional examination.

In this study, we focus on examining the IT business value from the perspective of IT resources. We employ non-physical IT resources instead of physical IT resources because physical IT resources are easily duplicated by rival firms and provide no sustained competitive advantage. The IT business value is investigated using the dimensions of human IT resources (i.e. portal usefulness) and IT-enabled intangibles (i.e. portal interface and service-oriented portal function), and their effects on perceived organizational performance. Our research findings may serve as practical indicators for policy makers, information service providers, and SME executives in the evaluation of elements for web portals for traditional industries while contributing to the literature on IT business value.

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Notes

1. SMEs in this study are companies with fewer than 200 employees or assets fewer than USD 3.4 million, as defined by the Taiwan Ministry of Economic Affairs, Taiwan, ROC.
2. Out of 753 SME who were members of this web portal at the time of the research, only 566 gave e-mail addresses.
3. Table of detail measurement of each scale and source of measurement is shown in Table AI.

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Further reading

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Appendix

Dimension/ variables	Measures	Reference
Portal usefulness		
Portal training	Sufficient time of training	Albors-Garrigos *et al.* (2009)
	The degree of easy to understand in training content	
	The thoroughness of training content	
	Training content is helpful in portal usage	Marchand *et al.* (2002)
Portal usage	High frequency of portal usage	Devaraj and Kohli (2003)
	The willingness of portal usage	Marchand *et al.* (2002)
	The convenience of portal usage	
Portal interface		
Operational friendliness	The easy to use of firm's product management	Lin (2008)
	The easy to use of firm's information management	
	The accessibility of portal information	Tarafdar and Zhang (2008)
Industry benchmark information	The helpfulness of industry benchmark information	Zhu (2004)
	The information accessibility in industry rivals	
	The information of industry ranking provided	
	The thoroughness of industry information	Zhu (2004)
Bilingual information	The necessity in providing bilingual information (e.g. English mode information)	
	The importance in providing bilingual information (e.g. English mode information)	
Portal service-oriented function		
Portal maintenance service	Reliability degree of back-management service	Pitt *et al.* (1995)
	Responsiveness in administrative support	Pitt *et al.* (1995)
	Assurance of service quality	Pitt *et al.* (1995)
	Content of services providing required by users	Pitt *et al.* (1995)
B2B function	The benefits obtained through trading via this web portal	Teo and Ranganathan (2004)
	The helpfulness of B2B in the development of new business opportunities	Lin *et al.* (2005)
	The helpfulness of B2B in the establishment of stronger linkage with sellers/buyers	Lin *et al.* (2005)
	The helpfulness of customer management	
Cloud computing	The necessity of cloud computing function	Greengard (2010)
	The degree of satisfaction with current cloud computing function	
	The importance of cloud computing	Greengard (2010)
Performance		
Finance	The increase of ROI	Gumbus *et al.* (2003)
	The increase of inventory turnover rate	Hvolby and Thorstenson (2001)
	The increase of sales revenue	Melville *et al.* (2004)

(*continued*)

Table AI. Table of detail measurement of each scale and source of measurement

Dimension/ variables	Measures	Reference
	The increase of market share growth	Kettinger *et al.* (1994)
	The reduction of expense and cost	Melville *et al.* (2004)
Customer	The increase of customer satisfaction	Hvolby and Thorstenson (2001)
	The increase of responsiveness	Hvolby and Thorstenson (2001)
	The increase of quality assurance	Hvolby and Thorstenson (2001)
Process	The increase of operational efficiency	Gumbus *et al.* (2003)
	The increase of needs understanding for internal and external processes	Hvolby and Thorstenson (2001)
Learning and growth	The degree of employee satisfaction	Hvolby and Thorstenson (2001)
	The improvement of new product development	Hvolby and Thorstenson (2001)
	The aggressiveness of employee's working attitude	
	The improvement of professional capability	
	The increase of employee retention rate	

Table AI.

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