DO THE DIFFERENT IT-RELATED ACTIVITIES REQUIRE DIFFERENT CAPABILITIES? THE RELATIONSHIP BETWEEN IT TASKS, EDUCATIONAL SKILLS AND TRAINING PROVISION

Research-in-Progress

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Abstract

This paper enquires into the relationship between the activities that IT professionals engage in and the educational skills and training provision that is provided to the IT workforce. To this effect, the paper on the one hand examines the degree of complexity and firm-specificity associated with the different types of tasks performed by IT professionals, whereas on the other hand it examines the educational skills and the amount of training that IT professionals need in order to perform such tasks. We test our hypotheses in the context of IT professionals in the IT Services Sector and the Retail & Wholesale sector. The paper holds implications for the IS literature, as well as IS practice in general, as it will help to better understand the optimal allocation of IT skills and investments in IT training, according the types of activities that IT professionals engage in.

Keywords: Skills, Training, IS Education

Introduction

In today's knowledge economy, firms need to continually nurture their human capital to gain a lasting competitive advantage. This is especially true for the information technology (IT) services industry, where employee costs and associated productivity are the major determinants of gross profits (Bapna et al. 2012). In this context, a number of studies within the human capital research community have enquired into the types of competences required by IT professionals, the effects of IT skills on productivity and performance (Aral et al. 2012), the effects of IT training provision on organizational performance (Bapna et al. 2012), the relationship between IT offshoring and skill composition (Tambe and Hitt 2012), and finally the relationship between the types of tasks performed by IT professionals and the types of employment formats required to perform such tasks (Mayer et al. 2012, Ang and Slaughter 2001).

Apart from this recent academic attention on IT skills, another recent trend concerns the growing amount of research on the types of tasks performed by IT professionals (Acemoglu and Autor 2010, Ang and Slaughter 2001, Mayer et al. 2012). Research on IT tasks seems justified, as knowledge work essentially consists of activities, tasks, or projects that require the application of knowledge to solve business problems (Meyer et al. 2012). Moreover, asking individuals what they actually do at work has been proposed as a way of overcoming a typical problem associated with similar studies using occupational data, namely that changes in occupational structures do not capture transformations of jobs within existing definitions (Green et al. 2001).

The present paper joins the works that have enquired into the types of tasks performed by IT professionals, but instead of focusing on the relationship between IT tasks and the different organizational dimensions (cf. Mayer et al. 2012), the present paper enquires into relationship between the educational skills that are required by IT professionals in order to perform the different types of IT-related activities, as well as into firms' willingness to invest in IT training according to the activities that IT professionals engage in. In sum, we pose the following research questions:

RQ1: Do the educational skills held by IT professionals determine the types of activities that IT professionals engage in?

RQ2: Do the types of activities that IT professionals engage in determine the extent to which firms are willing to invest in IT training?

Theoretical Framework

In order to better distinguish between the different types of IT-related activities and categorize them accordingly, we initially we initially draw some insights from the literature on task characteristics. In this respect, our research is informed both by some of the key works on task characteristics within the management literature (e.g. Campbell 1988) and also with some recent works within the IS scholarship that have explored the effects of the different task characteristics on IS usage and performance (Jiang and Benabasat 2007, Singh et al. 2011). Among the different task characteristics that have been identified by the literature, our research enquires into the relationship between IT task complexity and educational skills and training provision. We propose that using the concept of task complexity is appropriate in this context, as the varying levels of task complexity have also been seen as one of the main explanations for compensation between the IT sector and others; according to Ang et al. (2002), this can be attributed to the complexity of IT jobs that arises from the need to master relatively difficult technical concepts such as data modeling, process discipline, and systems design theory.

While siding with this approach, at the same time we seek to draw a distinction between varying complexity levels among the different types of IT-related activities. As a result, we seek to obtain a more fine-grained understanding of the role of job complexity among IT-related activities. Given that overall job complexity raises the need for significant educational skills, given that education enhances one's ability to receive, decode, and understand information (Bapna et al. 2012, Nelson and Phelps 1966), we initially hypothesize that the more complex IT-related activities require higher educational skills.

Hypothesis 1 (H1). The complexity of IT-related activities is positively related to the educational skills of

IT professionals.

Similarly, we also hypothesize that firms will have a higher incentive to invest in training that is related the more complex IT-related activities, as these activities are expected to be the most difficult to find in the marketplace and also offer the highest value-added to IT firms.

Hypothesis 2 (H2). Investment in IT training is positively related to the complexity of IT-related activities.

In addition to job complexity, one additional way of understanding the variation among IT-related activities pertains to the specificity degree of such activities. To explicate the notion of task specificity, we employ the framework developed by Castanias and Helfat (1991, 2001), who advanced three main types of managerial human capital that underlie firm capabilities, namely firm-specific, industry-specific, and general capabilities. Firm-specific human capital refers to knowledge and skills that are unique to a firm, such as knowledge about specific strategies, processes, and technologies of the firm. Industry-specific human capital refers to knowledge about the industry setting or domain in which a project is situated, and is thus redeployable across the firms with projects in the same industry domain. Last, occupational human capital consists of the knowledge and skills required to perform work within a professional or functional area, and as a type of general human capital, it is most easily transferred across industry and firm settings (Mayer et al. 2012, Castanias and Helfat 1991).

We argue that all types of IT-related activities require capabilities in the aforementioned categories, albeit at varying degrees. We thus expect employees engaging in more firm-specific activities to have higher non-academic skills (e.g. higher on-the-job experience). Similarly, we expect employees engaging in IT-related activities characterized by industry-specific capabilities to have higher technical skills. We also expect employees who engage in activities that require general capabilities to have higher domain skills.

Hypothesis 3a (H3a). The firm-specificity of IT-related activities is positively related to firm-specific skills held by IT professionals.

Hypothesis 3b (H3b). The industry-specificity of IT-related activities is positively related to the technical skills held by IT professionals.

Hypothesis 3c (H3c). The occupational-specificity of IT-related activities is positively related to the domain skills held by IT professionals.

We further hypothesize that the type of IT-related activities that employees engage in also has an impact on the provision of firm-provided training. Following the distinction between general and specific human capital investments Becker (1964), we argue that firms are more likely to make firm-specific investments in IT professionals who work in activities that require higher firm-specific capabilities. Similarly, we argue that

Hypothesis 4a (H4a). Investments in specific IT training are positively related to the firm-specificity of the activities that IT professionals engage in.

Hypothesis 4b (H4b). Investments in general IT training are positively related to the industry - specificity of the activities that IT professionals engage in.

Hypothesis 4c (H4c). Investments in general IT training are positively related to the occupational-specificity of the activities that IT professionals engage in.

Research Design

We draw our insights from a survey of IT professionals in the IT Services sector and the Retail & Wholesale sector in Malta. The survey was the result of a research project that sought to estimate the

demand and supply of IT skills in Malta[1]. Our final representative sample includes 72 firms in the IT Services sector and 101 firms in the Retail & Wholesale sector. Given that our aim is not to investigate the differences between companies but rather to understand which type of activity requires certain type of skills, our analysis is on the activity level, which results in 576 activity entries for 72 companies in the IT Services sector. We anticipate approximately 100 additional entries in our final data set from the firms in the Retail & Wholesale sector.

The questionnaire allowed us to obtain micro-level data regarding the types of IT-related activities that IT professionals in the two sectors engage in. We operationalized the different types of IT-related activities according to the e-Competences Framework developed by the European Commission (Figure 1).

1. **Business development, sales and marketing (BDSM):** Services related to consulting business managers on developing business markets, brands and values, and communicating these to the marketplace – e.g., consultancy provision; strategic business development; brand and value proposition development; sector marketing and lead generation; market intelligence and research; market communications; sales management and operations; etc.
2. **Business process management (BPM):** Services related to conducting business analysis, designing/redesigning business processes; managing the implementation of business change; designing/redesigning organisations; and ensuring benefits realisation.
3. **Programme and project management (PPM):** Services related to ensuring projects and programmes are completed successfully – e.g., Project inception and scope management; project planning and scheduling; project execution, monitoring and control; and project completion, acceptance and review.
4. **Solutions architecture (SA):** Services related to ensuring data, applications and systems are sufficiently integrated and standardised to support business operations – e.g., Systems Architecture; Data Analysis; Human Needs Analysis; Systems Analysis; Data Design; Human Computer Interaction/ Interface (HCI) Design; Systems Design; IT/Technology Infrastructure Design and Planning.
5. **Solution development and implementation (SDI):** Services related to creating, testing, integrating and implementing software solutions – e.g., Systems Development; Software Development; IT/Technology Solution Testing; Systems Integration; IT/technology systems installation, implementation and handover.
6. **Information management and security (IMS):** Services related to information management and security activities within an organisation – e.g., Information management; IT security management; IT disaster recovery.
7. **IT services management and delivery (ITSMD):** Services related to management of service delivery and the delivery itself of IT services, systems and assets to an organisation to support business functions. IT service operations and event management; Service Help Desk and Incident Management; Problem Management; Application Management / Support; IT Management And Support; Availability Management; Capacity Management; Service Level Management; Measuring and reporting.
8. **Global sourcing management (GSM):** Services related to defining and operating a sourcing strategy – e.g., Management of suppliers and supplier performance; Procurement of external IT resources, such as people, software, hardware, and licenses.

Figure 1: Types of IT-related activities according to the e-Competences framework of the European Commission

The survey items enabled us to obtain employee-level data regarding the level (e.g. PhD, Masters Degree) and the type (e.g. domain, technical, general) of IT skills. Similarly, we obtained micro-level data

[1] The research project was initiated in June 2011 and concluded in January 2013. The existing analysis only includes data from the survey of firms in the IT services sector. The results from the survey of IT professionals in the Retail & Wholesale sector will be soon be incorporated in the final data set.

regarding the provision of general and/or specific IT training according to each of the 8 sets of IT-related activities.

To measure the complexity and the firm-specificity industry-specificity, and occupation-specificity of the 8 sets of IT-related activities, we have involved a number of academic experts from 3 Universities, as well as experts from the research division of SAP AG.

Descriptive Statistics and Correlations

Variables in Table 1 are selected for our preliminary analysis.

Table 1. Descriptive Statistics

	Variable	N	Mean	Std. Dev.	Min	Max
1	Amountspentontraining	576	1092.795	5994.883	0	100000
2	BDSM	576	.125	.3310064	0	1
3	BPM	576	.125	.3310064	0	1
4	PPM	576	.125	.3310064	0	1
5	SA	576	.125	.3310064	0	1
6	SDI	576	.125	.3310064	0	1
7	IMS	576	.125	.3310064	0	1
8	ITSMD	576	.125	.3310064	0	1
9	GSM	576	.125	.3310064	0	1
10	NumberofFTEswithPhD	576	.0190972	.1510731	0	2
11	NumberofFTEswithMaster	576	.1753472	.7694793	0	7.5
12	NumberofFTEswithBachelor	576	.7065972	3.114831	0	34
13	NumberofFTEswithDiploma	576	.3984375	1.644918	0	16
14	NumberofFTEswithCertificate	576	.0251736	.3126835	0	6
15	NumberofFTEswithGeneralEduc	576	.0381944	.4053835	0	7
16	NumberofFTEswithOther	576	.0173611	.2609672	0	6

The correlation coefficients in Table 2 indicate three major significant correlations: (i) the dummy variable for solution development and implementation (SDI) is positively correlated with the number of FTEs with PhD, Master, Bachelor and Diploma, (ii) the dummy variable for IT services management and delivery (ITSMD) is positively correlated with the number of FTEs with diploma, general education and other, (iii) The amount spent on training is positively correlated with the number of FTEs with PhD, Master, Bachelor and Diploma. Furthermore, the amount spent on training is significantly negatively correlated with the dummy for global sourcing management (GSM) and the amount spent on training is positively correlated with SDI indicating that trainings are invested significantly in SDI activities.

Table 2. Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Amountspentontraining	1															
2	BDSM	-0.0391	1														
3	BPM	-0.0431	-0.143***	1													
4	PPM	-0.0512	-0.143***	-0.143***	1												
5	SA	0.0648	-0.143***	-0.143***	-0.143***	1											
6	SDI	0.159***	-0.143***	-0.143***	-0.143***	-0.143***	1										
7	IMS	-0.0185	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	1									
8	ITSMD	-0.00328	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	1								
9	GSM	-0.0690	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	-0.143***	1							
10	NumberofFTEswithPhD	0.198***	-0.0478	-0.0304	-0.0362	0.0681	0.155***	-0.0130	-0.0478	-0.0478	1						
11	NumberofFTEswithMaster	0.284***	-0.0452	-0.0600	0.0276	0.00256	0.179***	-0.00541	-0.0213	-0.0771	0.487***	1					
12	NumberofFTEswithBachelor	0.248***	-0.0718	-0.0557	-0.0355	-0.00316	0.221***	-0.0501	0.0806	-0.0858*	0.331***	0.524***	1				
13	NumberofFTEswithDiploma	0.292***	-0.0347	-0.0714	-0.0230	-0.0437	0.162***	-0.0395	0.118**	-0.0671	0.156***	0.256***	0.591***	1			
14	NumberofFTEswithCertificate	0.00648	0.0760	-0.0305	0.0424	-0.0305	-0.00805	-0.0305	-0.00525	-0.0137	-0.0102	0.0997*	-0.00222	0.254***	1		
15	NumberofFTEswithGeneralEduc	0.00296	0.0594	-0.0356	-0.0227	-0.0356	-0.0184	-0.0227	0.111**	-0.0356	-0.0119	-0.0215	-0.0200	0.187***	0.569***	1	
16	NumberofFTEswithOther	0.0546	0.00839	-0.0117	-0.0252	-0.0252	0.00839	-0.0252	0.0956*	-0.0252	-0.00842	0.170***	0.0379	0.104*	0.0159	-0.00628	1

* p<0.05, ** p<0.01, *** p<0.001

To further conduct our analysis and test our hypotheses, we are currently evaluating different regression techniques. These include ordinal logistic regression, multinomial logistic or probit regression and multiple logistic regression analyses for each pair of outcomes.

Conclusion

The main aim of this paper is to explicate the link between the activities that IT professionals engage in and the educational skills and training that are needed to perform such activities. In this respect, the paper joins a recent stream in the IS literature that has started to enquire into the effects of IT tasks/activities on different aspects of organizational performance, with the notable difference that we set out to explore the antecedents of the successful performance of IT tasks. The present paper holds significant implications for the IS literature, as it offers a more in-depth insight into the optimal allocation of IT skills and investments in IT training. The paper achieves this by studying the skills and the provision of training to IT professionals according to the actual activities that these professionals engage in, thus overcoming the limitations found in similar studies that use occupational data. The study also holds implications for IS education in general, as an activity-based view of IT skills will offer a more valid and fine-grained picture of the actual skills and competences required by the IT workforce.

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