TRENDS IN IT HUMAN RESOURSES AND END-USERS INVOLVED IN IT APPLICATIONS

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ABSTRACT

The Bureau of Labor Statistics projected the demand for information technology (IT) human resources to increase by 13.26 percent between 2014 and 2024. In this survey research, the IT professionals estimated a growth of 34.16 percent in IT human resources over a period of five years from the year 2016. The goal of this survey study was to try to understand the discrepancy in the estimates for IT Human Resources requirements by developing a theory-driven model to evaluate the impact of growth in IT outsourcing/offshoring, cloud-computing, end-users-computing, IT applications, and usage of commercial-off-the-shelf/ERP on the need for IT human resources.

KEYWORDS: IT Human Resources, End-users-computing, Cloud computing, IT outsourcing/offshoring, COTS/ERP

INTRODUCTION

The average Information Technology (IT) investment reported a IT Trends Study was 5.3% of their gross revenue (Kappelman, et al., 2016) and it takes up about 50% of total capital costs (Applegate et. al. 2009). The Bureau of Labor Statistics (BLS) (2016) reveals that between 2014 and 2024 the IT labor pool is expected to increase by 13.26 percent from 4.03 million in 2014 to 4.56 million in 2024, indicating the criticality of IT in the growth of US economy. This trend is attributed to greater adoption of new technologies such as cloud computing, software as a service (SaaS) and Enterprise Resource Planning (ERP) packages among others (Luftman et al., 2015) and is likely to have an impact on the requirements of IT human resources and the role of End-users involved in IT function.

However, data for 2014-2019 indicates that the allocated budget for IT human resources has decreased by 10 percent while allocated budget on infrastructure - hardware, software, and networking - has increased by 10 %. The ratio of spending on IT human resources to infrastructure, has shifted from 60:40 to 50:50 during that time, suggesting an impact of new technology-driven business processes such as IT outsourcing/offshoring, cloud computing, end-user computing, usage of commercial-off-the-shelf (COTS)/ERP software on hiring.

This study is an attempt to understand the factors that influence IT-related hiring decisions by corporate managers. Using a survey research method, senior executives in the United States IT industry were requested to provide information

on their future plans for hiring IT personnel. Several hypotheses, driven by relevant literature, were developed and tested to explore the relationships between business process adoption and hiring IT personnel.

LITERATURE REVIEW

The literature review was done using key words to query the Business Source Premier database. The pertinent articles were identified and are referred to in the literature review, with a greater focus on recent scholarly works.

A review of the literature in Information Systems, Operations Management, Supply Chain Management, and related fields indicates that trends and descriptive studies in COTS, proprietary & ERP packages, cloud computing, and IT outsourcing/offshoring have been conducted extensively by IS researchers. However, there is a paucity of research on the impact of IT evolution on requirements for human resources within the IT industry. One of the first studies to quantify the trends in IT human resources was Agrawal (2005). This study extends that model, and tests it validity.

In Agrawal's model (Agrawal, 2005), there were five independent constructs:(i) growth in IT applications, (ii) support to End-users from technical component of IT, (iii) drivers to involve End-users in IT function, (iv) growth in End-users computing, and (v) off-the-shelf/ERP solutions vs. proprietary application packages; the dependent construct was growth in requirements of in-house IT professionals. The new model proposed in this article includes two additional independent factors -- (vi) growth in IT outsourcing/offshoring and (vii) growth in cloud servicing. The independent variables, growth in End-users computing, off-the-shelf/ERP solutions vs. proprietary application packages, growth in IT outsourcing/offshoring and growth in cloud computing were hypothesized to lead to a decrease in growth of in-house IT professionals. However, growth in IT applications, was hypothesized to lead to an increase in the dependent variable. Each of the six constructs: growth in IT outsourcing/offshoring, growth in cloud computing, off-the-shelf/ERP solutions vs. proprietary application packages, growth in End-users computing, growth in IT applications, and in-house IT human resources, in five parts, along with their hypothesized relationships.

Growth in IT outsourcing/offshoring:
 In this section, we discuss the trends and effects of outsourcing/offshoring in manufacturing and consumer-service sectors since the changes in these areas often replicate in the IT sector eventually. Hummels et al. (2001) calculated that

international outsourcing accounted for approximately 30% of the world's export, growing more than 30% between 1970 and 1990. They found that overall outsourcing varies widely across the OECD countries, ranging from less than 10% of GDP in countries like Japan and Australia to more than 30% in countries like Canada and the Netherlands. Mann (2003) calculated that globalized production and trade made information technology hardware 10% to 30% cheaper than it would have been otherwise. Oldenski (2014) asserted that offshoring negatively affected employment for routine tasks but positively influenced employment for high-end non-routine and communication-task intensive jobs. This is true in the IT sector too where firms in countries that are conservative in international outsourcing have come under pressure to carry out the international outsourcing (Lo, 2014). For example, while the US based Microsoft substantially employs the international outsourcing strategy to compete in the game console industry, the incumbent Japanese firms were generally more conservative regarding outsourcing abroad. However, in response to Microsoft's general production cost savings from outsourcing, Sony had to employ the international outsourcing strategy by outsourcing its PlayStation game console to Foxconn, a Taiwanese firm whose major production facilities are located in China.

Ebenstein et al. (2014) stated that between 1983 and 2002, the U.S. economy experienced a boom in offshoring to low-wage countries. Over this same period, roughly 6 million jobs were lost in manufacturing. Feenstra and Hanson (1999) studied the impact of outsourcing and high-technology investments by US firms on employment. They found that in the manufacturing sector workers primarily engaged in routine tasks, such as in blue-collar occupations, suffered the greatest job losses from globalization. Ebenstein et al. (2014) find that domestic employment has declined in industries expanding into low-wage-countries. The increase in offshoring activity resulted in a reduction in such U.S. workforce by almost 40% between 1982 and 2002. The results of Munch (2010) indicated that international outsourcing, when broadly defined, increases only less-skilled workers' unemployment risk.

Becker and Muendler (2008) analyzed the impact of foreign direct investment (FDI) on job security and found that multinational enterprises (MNEs) that expand abroad retain more domestic jobs than did competitors without foreign expansion do, likely because of the higher-end coordination and communications required.

While outsourcing/offshoring may reduce jobs by substituting foreign labor for domestic labor, it may also increase jobs through effects that favor domestic firms' productivity (Bandyopadhyay et al., 2014). This latter effect suggests that under certain situations outsourcing and domestic job growth may be complements.

Indeed, some previously discussed empirical papers find evidence of such complementarity (Bandyopadhyay et al., 2014). Therefore, this suggests that legal barriers to outsourcing may prove to be counterproductive by reducing domestic job opportunities.

In summary, studies suggest that on one hand outsourcing/offshoring places a greater burden on individuals who perform routine tasks whose jobs can be outsourced, while on the other hand such a strategy calls for higher end tasks of greater coordination and communications resulting in need of greater human resources internally. Given that workers elsewhere can easily copy routine tasks, and such tasks outnumber higher-end tasks required of outsourcing/offshoring, the strategy in IT will lead to net negative growth in requirements for IT human resources.

Research Hypothesis H1:
The Growth in the Requirements of in-house IT Professionals is inversely related to Growth in IT Outsourcing/offshoring.

Growth in cloud computing:
In the 20th century, technology governance was largely about standards and centralized management. Moving into 21st century, this model began to change, first from centralized to federated technology governance models, then to participatory models (Andriole, 2015). Historically, technology governance has been more explicit and formalized around operational technology (such as laptops, desktops, networks, storage, and security) than strategic technology (such as business applications and special-purpose hardware) or around emerging technologies (such as social media, location-based services, wearables, and the Internet of things) (Andriole, 2014; Weill and Broadbent, 1998; Weill and Ross, 2004).

Old notions of technology governance are being challenged by technology commoditization, consumerization, alternative technology-delivery models, and other emerging technologies such as cloud-computing about to hit their problem-solving stride (Andriole, 2015). For many companies, the technology governance models are evolving as they globalize and integrate vertically and horizontally, requiring the acquisition, deployment, and supporting IT via the "cloud". Many business leaders see the 'cloud' as an engine for growth and job creation (Neumann, 2014).

According to McKinsey's IT-as-a-Service (ITaaS) Cloud and Enterprise Cloud Infrastructure surveys enterprises, in the next three years, will make a fundamental

shift from building IT to consuming IT (Elumalai et al., 2016). Furthermore, enterprises are planning to transition IT workloads at a significant rate and pace to a hybrid cloud infrastructure, with off-premise environments seeing the greatest growth in adoption. While cost is often perceived to be the main driver of this shift, the McKinsey's survey research (Elumalai et al., 2016) shows that benefits in time to market and quality are driving cloud acceptance, while security and compliance remain key concerns for adoption, particularly for large enterprises. The survey reveals that there will be a decline in number of companies from 77 percent to 43 percent between 2015 and 2018, which will use the traditional build option. During the same period, there will be an increase in usage of dedicated private cloud by companies from 38 percent to 57 percent, virtual private cloud by companies from 34 percent to 54 percent, and public ITaaS by companies from 25 percent to 37 percent. In another worldwide survey, conducted by technology research firm 451 Research in May and June 2016, the findings were that the level of enterprise workloads in the cloud is expected to go from 41% today to 60% by mid-2018 (Gaudin, 2016). These developments will no doubt influence IT human resources requirements within firms.

Cloud computing frees firms from micro-management by a monolithic, centralized corporate IT (Andriole, 2015). The adoption of cloud technologies frees up the need for IT staff to handle operational concerns.

The break-neck pace of technological innovations however makes it cost prohibitive for firms to ceaselessly buy and deploy new technologies and acquire the necessary skilled personnel to derive the associated competitive advantages. Further propelling the adoption of cloud services is the growth of renting hardware and software (versus buying and installing) as a viable alternative for many companies (Andriole, 2015). This calls for new technology governance models. Vendor management has emerged as a core competency for many companies. Service-level agreements must be managed and evaluated. All these lead to the need of IT personnel with the skills to manage and govern this evolving technological environment.

In summary, while some increase in staffing is to be expected for technology governance in the new and dynamic IT environment, the lack of need for staffing to manage hardware and software internally will be severely diminished leading to a net negative change in the in-house IT human resources as cloud services continue to be adopted.

Research Hypothesis H2:
The Growth in the Requirements of in-house IT Professionals is negatively associated with the Growth in Cloud Servicing.

Sourcing application packages:
The shifting role of IT as a strategic necessity will affect strategic decisions regarding the level of corporate investment in IT (Carr, 2003, 2013). When organizations have an opportunity to use IT as a strategic advantage, the organizations will maximize investments to develop and process in-house IT applications and maintain control of IT activities. Not only are organizations increasingly moving to the cloud to decrease their investments in IT infrastructure, they are also engaging in initiatives to reduce costs by moving away from proprietary application packages such as for ERP to Commercial-Off-The-Shelf software solutions (Luftman et al., 2015). Luftman et al. (2015) forecasts that over the next 3 – 5 years organizations will shift IT spending to COTS/ERP in a desire for flexibility.

In a free market, it is very difficult to create and maintain a sustainable competitive advantage (Porter, 1980). This is true when using IT as a competitive advantage as well. When a competitive advantage is achieved, the duplication time is very short (months, not years) once a rival's IT is understood. Hence, organizations such as Wal-Mart, Dell, and Jet-Blue have used proprietary IT application packages to gain a sustainable competitive advantage in the marketplace (Wailgum, 2007). By using proprietary software, these companies and others have been able to add capabilities that were hard for their competitors to copy as long as the capabilities remained confidential. However, the continuously evolving and short-product life cycle of IT products (Allen, 1992; Hecker, 1999; Sahadev & Jayachandran, 2004) results in frequent and often expensive changes to proprietary application software packages leading to growth in usage of COTS/ERP application packages (Agrawal et al., 2016). In the fast moving IT sector, developing customized software can only be a short-term competitive advantage given the time it takes to develop, test, and deploy such software before it needs changes and upgrades. Hence, companies have begun to favor COTS/ERP software, the benefits of having upgraded and most current application packages outweighing the costs of developing and maintaining proprietary packages. Even companies such as Wal-Mart that have traditionally believed in building and maintaining application packages in-house have started to adopt some commercial application packages (Wailgum, 2007) while at the same time building new custom applications when there is a potential to gain a large strategic advantage.

Firms which increase their use of COTS/ERP will have little need for IT Human resources to manage application packages and provide the necessary support to their users. Firms which, for reasons of having a sustainable competitive advantage, seek to develop their own application packages despite the additional costs will have address the need for a greater level of IT human resources.

Research Hypothesis H3A:
Greater use of COTS_Non-ERP Software Packages in the company will be negatively correlated with Growth in the Requirements of in-house IT Professionals.

Research Hypothesis H3B:
Greater use of COTS_ERP Software Packages in the company will be negatively correlated with the Growth in the Requirements of in-house IT Professionals

Research Hypothesis H4A:
The use of Proprietary Non-ERP Software Packages in the company will be positively correlated with the Growth in the Requirements of in-house IT Professionals.

Research Hypothesis H4B:
The use of Proprietary ERP Software Packages in the company will be positively correlated with the Growth in the Requirements of in-house IT Professionals.

Growth in End-users computing:
The growth in the importance of information technology as part of an enterprise's basic infrastructure is propelled by evolutions in hardware, software, and the graphic user interface (GUI) which facilitates the use of IT applications by end-users. The growth in the ease of use of software applications has been the catalyst to hiring non-IT personnel to carry out many business-process tasks and this growth is expected to continue. The radical transformation of business processes away from IT-centric computing to increased adoption of end-user computing (EUC) has fundamentally changed the way businesses operate. This trend accelerated in the 1980's when the effectiveness of business-software development became a key Management Information Systems (MIS) issue. The challenge of meeting the growing need for on-demand information to make decisions in the fast-paced global business environment was resolved with the arrival of end-user computing. Trends in hardware and software such as miniaturization, speed, connectivity, interactivity, multimedia, and affordability (William and Sawyer, 2015) have contributed to the growth of end-users computing by providing more support to end-users from the technical component of IT (Agrawal, 2005) and automation in application software

development (Venkatesan, 2015). These factors along with the need for information on demand, and specialized skills required to learn the operation/maintenance of packages associated with the challenge of finding the related knowledge workers are drivers pushing the IT industry toward involving end-users in the IT functions (Agrawal 2005). The shifting of information systems control to end-users (Edberg and Bowman, 1996; He et al., 1998; Lucas, 2000) has led to decreasing the budgets of IS departments.

The end-users' are taking more and more responsibilities of information systems applications, and their involvement is positively correlated with the success of information systems (Doll and Torkzaddah, 1988; McLean et al., 1993; Winter et al., 1997). Turban et al. (2011) claimed that many of the user requirements are smaller in size and can be developed by end-users themselves.

Expert systems using artificial intelligence (AI), which help businesses make better decisions faster, became significantly end-user friendly and hastened the adoption of end-user computing. Examples range from executives using such applications to build complex risk analysis models to cashiers using them to identify produce (Sadahiro, Checkley, and Trivedi, 2001).

The advance of natural language processing further leads to simpler user interfaces. The graphical user-interface (GUI) makes the applications end-user friendly allowing the end-users to communicate with the application more effectively in their familiar vocabulary. These trends have led to the development and adoption of Web 2.0 applications that allow the user to customize the way they interact with the virtual world. Customers expect businesses to be able to provide an interactive experience for viewing bills, shopping, and getting support among other traditional activities. This trend has important implications for the type of employees human resource departments need to hire. Employees who are technology-illiterate will not have the needed skills to fully leverage Web 2.0 technologies. Employees who have extensive technical skills lack knowledge of business processes and skills to interact with customers. Therefore, firms will seek out those with a background in business but who have the ability to quickly grasp the technology skills required of end-users.

The trend toward more end-user computing will reduce the number of tasks that are required of in-house IT professionals as end users are increasingly able to accomplish tasks that formerly required an IT professional. This trend will be across industries. Some companies will see a growth in the number of IT professionals required to support functions not previously offered. Accordingly, the human resource professionals at those companies will need to work closely with the firms'

IT department to identify areas of need. Since the overall trend should be toward a reduction of in-house personnel dedicated to IT infrastructure, it is important that sources for essential entry-level personnel be identified.

This has led to the growth of shadow IT (the end users provisioning IT applications without the approval/knowledge of IT department) environment within the organization. The growth in EUC will lead to higher usage of external services such as cloud computing and less reliance on in-house IT departments.

Automation in Application Software Development:
Venkatesan (2015), the former Chairman of Microsoft India, stated that the IT industry's party is over and now is the time to reinvent or perish. "A combination of slowing demand, rising competition and technological change means that companies will hire far fewer people. And this is not a temporary blip – this is the new normal." Wipro's CEO has stated that automation can displace a third of all IT related jobs within three years. Infosys CEO Sikka is endeavoring to raise revenue per employee by 50%. "Even NASSCOM, the chronically optimistic industry association, admits that companies will hire far fewer people" (Venkatesan, 2015). The "creative destruction" in the industry is eliminating many old jobs and replacing them with new ones which require fewer IT human resources. There is an insatiable demand for developers of mobile and web applications, data engineers and scientists, and cyber security experts with abundant employment opportunities. As per Computerworld's 2017 survey, US companies need software developers who can support the increasing automation happening within IT (Collett, 2017).

Furthermore, using currently demonstrated technologies, the number of tasks that can be automated, would affect $14 trillion in wages and a billion jobs (Greensberg et al., 2017) in total, which includes IT jobs. Furthermore, an Oxford Varsity study says that 47 percent of modern day jobs will be claimed by automation by 2033 (The Economic Times 2017b) and automation could raise productivity growth globally by 0.8 to 1.4 percent annually (Manyika et al., 2017). Gartner predicted that smart machines, including cognitive computing, artificial intelligence, intelligent automation, machine learning, and deep learning, will enter mainstream adoption by 2021 with 30% adoption by large companies. This adoption rate will help drive spending on smart machine consulting and system integration services from $451 million in 2016 to $29 billion in 2021. The technologies within smart machines is expected to be adopted at different speeds and timings, with the majority of smart technologies becoming mainstream between 2020 and 2025 (The Economic Times 2016). The next generation of tools could unleash even bigger changes. New machine-learning and deep-learning capabilities have an enormous variety of applications – customer service, manage logistics, analyze medical

records, or even write news stories –- that stretch into many sectors. These technologies could generate significant productivity gains, but also carry the risk of causing job losses and dislocations. About 45 percent of work activities could be automated using current technologies, some 80 percent of that attributable to existing machine-learning capabilities, and natural-language-processing could further expand that impact (Henke et al. 2016). According to a recent report by US-based research firm HfS Research, IT industry worldwide would see a net decrease of 9% in headcounts, or about 1.4 million jobs due to automation in next five years (Mishra, 2016). Furthermore, many occupations and workplaces are at risk because of technical progress and massive productivity increase. According to an Oxford study, about 47% of total US employment is at risk in the coming 10 to 20 years (Frey and Osbornem, 2013) because of the exponential growth of computing power, artificial intelligence, cloud computing, machine learning, robotics, 3D printing, big data, and the Internet of Things. These technologies are creating and making accessible new products and services for massive consumption at an unprecedented pace, but also threatening jobs in the occupation of all skill categories (Ford, 2015; Manyika et al., 2013; Pratt, 2015; Rifkin, 2015; Sachs et al, 2015).

This automation in application software development will lead to increases in End-users computing and declines in the requirements of IT professionals for In-house and with outsourcers, cloud computing, and software developers.

Research Hypothesis H5:
The Drivers to involve End-Users in IT Function in the company will positively affect the Growth in End-user Computing.

Research Hypothesis H6:
The Support to End-users from Technical Components of IT will be positively correlated to the Growth in End-user Computing.

Research Hypothesis H7:
The Growth in End-user Computing in the company will have a negative effect on Growth in requirements of in-house IT professionals.

Growth in IT applications:
The average IT investment by U.S. organizations is approximately 3.5 to 7.0% of their sales revenue (Network World, 2009) and contributes up to 50% in total capital costs (Applegate et. al., 2009). IT is essential to survival for most businesses. In the US, former President Obama requested a decrease of 2.9 percent in spending for IT projects for fiscal year 2015 bringing the total requested IT spending for the United States Government to $79 billion (Information Week, 2014). This savings

of $2.4 billion (2.9 percent) is attributed to consolidation of commodity IT, eradication of duplication, and cutting waste. Between 2011 and 2014, the Federal Government IT spending increased from $79.4 billion to $81.4 billion. As per Gartner, the global spending on IT was expected to be up 1.4 percent to $3.5 trillion in 2017 (The Economic Times, 2017a). However, the IT spending per user is significantly lower than the years 2012-2014 (Computer Economics, 2017). This increase in spending is likely to be driven by demand for new technologies such as cloud computing, software as a service (SaaS) and Enterprise Resource Planning packages among others (Luftman et al., 2015).

Reliance upon information technology is pervasive and is likely to become more so in the future. Businesses are moving toward great use of software solutions to satisfy customer demand, and increase business-process effectiveness and efficiency. This is leading to an overall growth in demand for IT applications that is driving the greater need for both proprietary and COTS/ERP software. As an example, customers increasingly want to utilize their mobile communications devices, such as smart phones, netbooks, and tablet computers, to check their account information online. This creates a demand for a service that many businesses have to satisfy. Because of the availability of cloud computing, decline in the prices of IT resources, and more processing power of computing infrastructure, many small and medium size companies can afford IT applications for their organizations (Srinivasan, 2013). This is helping to continuously increase IT investments worldwide every year. Furthermore, new developments in IS such as business intelligence, mobile computing, web-enabled transactions, etc. will boost the usage of IT applications in every organization. However, the limitation in IT budgets will lead to the usage of cloud computing to a higher degree, reducing the need for internal IT professionals (Himmel and Grossman, 2014). This in turn will help in growing end user computing within the organizations.

Research Hypothesis H8:
The Growth in IT applications in the company will be positively affect the Growth in the Requirements of in-house IT professionals.

Figure 1 pictorially presents all the eight hypotheses developed through the literature review.

METHODOLOGY

Following the guidelines suggested by Dillman (1978, 2000), Tanur (1982), and Pinsonneault and Kraemer (1993) and used by management information systems scholars for several years, survey research was conducted for this study.

A questionnaire survey was implemented to test the eight hypotheses. The sample was comprised of executives from the manufacturing and service sectors in the United States. Based on a literature review a 6-page questionnaire was developed to measure variables of interest after establishing face validities. To mitigate non-responses no open-ended questions were utilized. Additionally, a principal component factor analysis with Varimax rotation was conducted to extract the four constructs named "Growth in IT Applications," "Growth in End-user Computing," "Drivers to involve End-Users in IT Function," and "Support to End-users from Technical Components of IT".
The questionnaire items were finalized after further assessing the items for face validity.
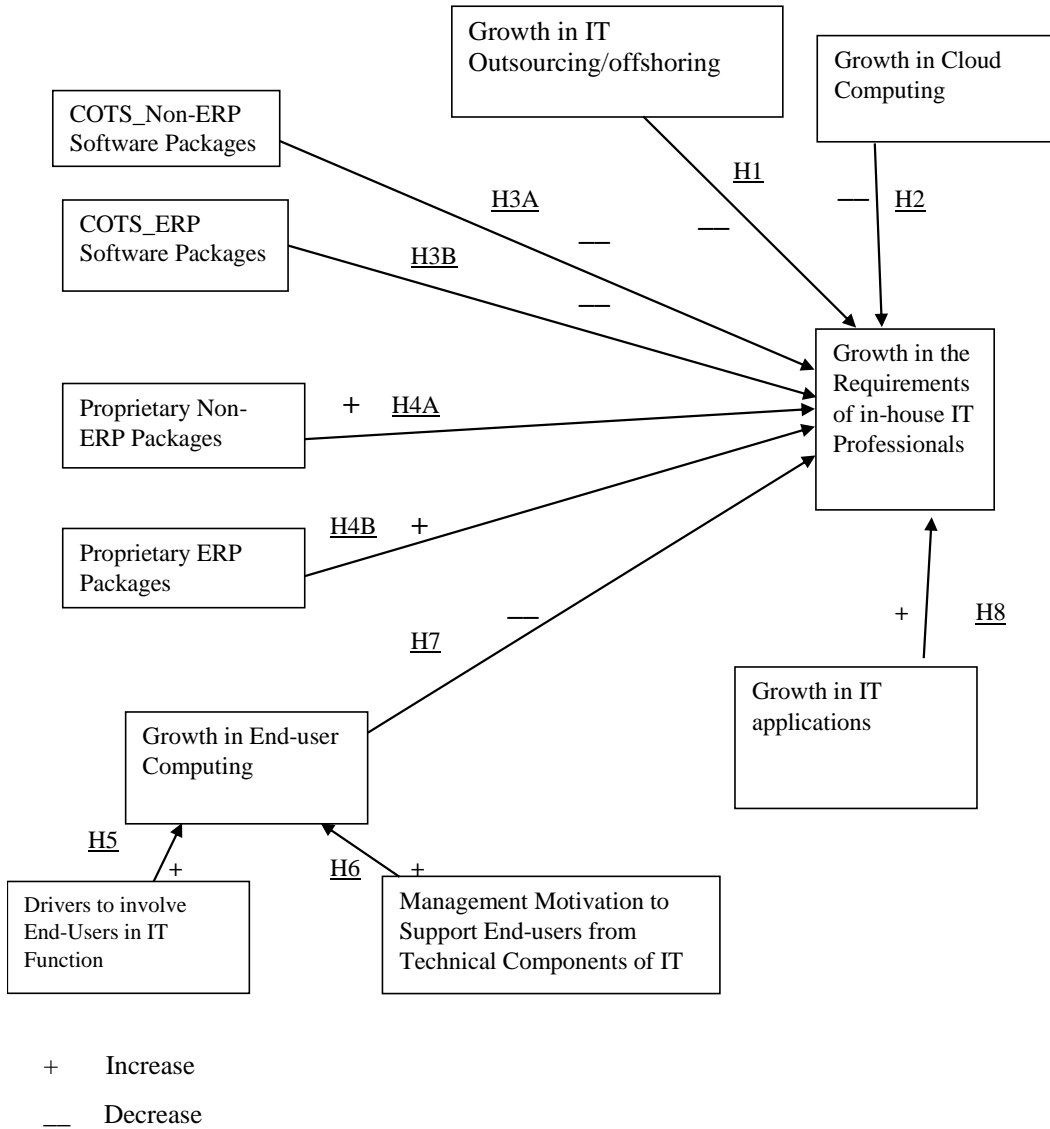
Figure 1: Modified Conceptual Model – Requirements of IT Human Resources Planning for Human Resources

Face validity: Face validity is a necessary condition for ensuring construct validity of the questionnaire items (Hardesty & Bearden 2004). Face validity is simply a subjective assessment of whether an item or question measures what it claims to measure. Face-validity of each item was assessed in three steps. First, a list of items were initially developed for the questionnaire by the authors with expertise in the Management, MIS and IT disciplines. These items operationalized the variables of

interest. A preliminary consensus was reached among them on the question-phrasings that evoked acceptable face-validity. Then, independently, each judge again assessed the face validity of each item. Each judge's assessments were then compared with each other for inter-rater concordance and the questions rephrased as required. Finally, four IT executives from different firms were asked to comment on the question phrasing and the time required to respond. The Delphi technique has been used to poll and aggregate information from experts in a number of management disciplines (Flostrand 2017). Based on the feedbacks from them, and using the Delphi technique, the phrasing of the questions measuring the variables settled and finalized when all seven experts agreed that face-validity was achieved for all items.

Data Collection:

Following the guidelines suggested by Dillman (1978, 2000), the questionnaire was administered. The targeted sample was IT professionals with some responsibility for making IT management decisions for organizations based in the United States. The sampling frame was a fee-based online panel of IT professionals offered by Qualtrics, a leading online survey research platform. Blankenship, Breen, and Dutka (1998) indicated that such online panels were of lower cost, provided faster responses, and had the ability to obtain a targeted sample of people who are scarce in the general population.

The questionnaire survey was sent to a panel of senior managerial IT professionals (directors, chief information officers, IT managers, etc.) of firms in the United States. Those receiving invitations to participate were selected from a pool of IT professionals who have registered to participate in Qualtrics online surveys and polls. Subjects were given the choice to opt-out of taking the survey. Those who chose to participate were first asked to indicate the industry they were employed in. To ensure adequate representation of each industry type, target quotas of 80 service sector responses and 70 manufacturing sector responses were established. The service sector industry type had an additional target quota of 40 respondents in the Computer Software industry sector and 40 respondents for other service industry sectors. Once a quota was reached, Qualtrics deactivated the links given in the invitation to participate for that particular sector. The deactivated links were based upon the industry each respondent's panel profile indicated they were employed in. Respondents who began a survey before the link was deactivated were allowed to finish the survey. Out of the initial sample size of 153, the total of 148 usable responses were received, resulting in a 97% response rate.

Table 1: Level of Respondents in the Organizations and their Functional Departments

What is your level in the organization	No. of responses	%	Which functional department do you work	No. of responses	%
Executive	53	36%	Accounting	4	3%
Directors	35	23%	Administration	9	6%
First Line Management	28	19%	Engineering	12	8%
Middle Management	32	22%	Information Systems	116	79%
			Production	1	1%
			Sales/Marketing	4	3%
			Other		
			--Purchasing	1	1%
			--Development/Support	1	1%
	148	100%		148	100%

Respondent profile:

It was a fair representation of the intended population in the sample (Tables 1 and 2). Seventy-nine percent of the respondents were from IT departments, as intended for this survey research. The remaining respondents were directly associated with the IT department. The senior level management was represented to a higher degree than mid-level managers were. In most of the respondents' organizations the fulltime IT employees were 100 or higher and having an IT department budget of more than $10 million.

Table 2: Number of Full-time Employees and IT Budget

Full-time information systems' employee in your organization	No. of responses	%	Budget of organization's IT Department	No. of responses	%
1 to 25	16	11%	Up to 10 million	57	39%
26 to 100	19	13%	10 million to 25 million	35	23%
101 to 500	38	26%	25 million to 50 million	40	27%
501 to 1,000	34	23%	More than 50 million	16	11%

1,000 to 2,000	26	17%			
More than 2,000	15	10%			
	148	100%		148	100%

Table 3: Items loading on the constructs

	Item	Description	Component			
			1	2	3	4
E2_1	1	The hidden backlog of information demand	.257	.260	.337	.827
E2_2	2	The evolution in hardware/ software	.532	.373	.201	.601
E2_4	4	Little skill required to learn the operation/ maintenance of packages	.190	.405	.648	.303
E2_5	5	Availability of knowledge workers	.248	.379	.793	.195
E2_6	6	Availability of reliable packages	.429	.174	.783	.232
E2_8	8	Willingness of top executive to advocate usage of information technology	.709	.328	.445	.186
E2_9	9	Willingness to change	.792	.324	.302	.222
E2_10	10	Growth in usage of information technology	.709	.368	.234	.368
E2_12	12	End-users are skilled in computer literacy	.352	.672	.339	.338
E2_13	13	Availability of user-friendly tools for developing and maintaining applications	.383	.771	.352	.181
E2_14	14	Automation in application software development	.317	.764	.292	.268

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.
Factor 1: Growth in IT Applications
Factor 2: Growth in End-User computing
Factor 3: Drivers to involve End-Users in IT function
Factor 4: Management motivation to support End-users in IT function

Table 4. Factor Analysis – Loading and Variances in the Identified Factors

Factor	# of items	Eigenvalue	% of Variance
Growth in IT Applications (Factor 1)	3	7.608	69.163
Growth in End-User computing (Factor 2)	3	0.667	6.062
Drivers to involve End-Users in IT function (Factor 3)	3	0.536	4.870
Management motivation to support End-users in IT function (Factor 4)	2	0.498	4.526

Operationalizing Constructs:

Factor analysis is widely used in the analysis of survey data for exploring latent variables underlying responses to survey items, and for testing of hypotheses about

such latent variables (Van der Eijk, C., & Rose, J. 2015). The four multi-item constructs, namely, "Growth in IT Applications," "Growth in End-user Computing," "Drivers to involve End-Users in IT Function," and "Management motivation to support End-users in IT function", were extracted from the 148 valid responses through a principal component factor analysis with Varimax rotation of the 14 items which were judged to measure the four constructs. In determining the number of factors for each construct "eigenvalue greater than one" rule is recommended (Churchill, 1979). Factor analysis can achieve an accurate solution with a sample size of 150 observations or more if intercorrelations are reasonably strong (Guadagnoli and Velicer, 1988) so the sample size is considered adequate. For exploratory analysis, the selection of the number of factors is determined by both the underlying theory used to develop the instrument and empirical results (Hinkin et al., 1997).

Table 5: The Constructs with Measuring Data Items

Item	Factors	Data Items with Revised Model	Cronbach's Alpha
1	Management motivation to support End-users in IT function (Factor 4)	The hidden backlog of information demand.	0.826
2		The evolution in hardware/ software.	
4	Drivers to involve End-Users in IT function (Factor 3)	Little skill required to learn the operation/ maintenance of packages.	0.873
5		Availability of knowledge workers.	
6		Availability of reliable packages.	
12	Growth in End-User computing (Factor 2)	End-users are skilled in computer literacy.	0.910
13		Availability of user-friendly tools for developing and maintaining applications.	
14		Automation in application software development.	
8	Growth in IT Applications (Factor 1)	Willingness of top executive to advocate usage of information technology.	0.908
9		Willingness to change.	
10		Growth in usage of information technology.	

The factor analysis yielded four factors. Principal factor analysis with Varimax rotation was also conducted with 3 and 5 factors to test for the possibility that the items might better match up to a different factor structure. After evaluating all three data-reduction models, it was determined that the 4-factor model explained the variation the most. Loadings greater than 0.40 in absolute value are suggested as the criterion for significant factor loadings (Ford et al., 1986) and eleven of the fourteen items met the criteria. The eleven items generally loaded under the constructs they were expected to measure (Table 3). The summary of each

constructs factor loadings and its reliability as assessed by determining its Cronbach's Alpha are presented in Table 4 and Table 5 respectively.

"Growth in IT Applications" explained the most of the scale variance. All four factors have Cronbach's alpha reliabilities that were within the traditionally acceptable range of above 0.70 (Nunnally, 1970). Therefore, the exploratory factor analysis and reliability provides a confidence in proceeding with a confirmatory factor analysis. A maximum likelihood confirmatory factor analysis was conducted to evaluate the 4-factor model's goodness of fit. A value below 0.90 for Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) rejects the hypothesis that the model is a good fit (Kenny, Kaniskan, and McCoach, 2015). Both Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values were above 0.90, with CFI of 0.962 and TLI of 0.945. These values and the high reliability values of each construct lead to the conclusion that the 4-factor loadings are acceptable.

RESULTS

The results of the hypotheses testing are discussed in two parts within this section. First the hypotheses testing the direct relationships between one of the four factors on the "Growth in Requirement of in-house IT professionals" is discussed (Table 6). This then followed by the discussion of the two hypotheses testing the predictors of "Growth in End-user Computing" (Table 7).

Factor scores for the four factors – Drivers to involve End-Users in IT Function, Management Motivation to Support End-Users from Technical Components of IT, Growth in End-User Computing, Growth in IT Applications - were first computed using SPSS Version 23.0.

The testing of the hypotheses proceeded in two stages. In the first stage a correlation analysis was conducted to identify the hypotheses that could be rejected off-the-bat. Then a stepwise-regression was conducted to test the remaining hypotheses. The results of correlation analysis are tabulated in Table 6.

A correlation analysis of the variables in the study revealed that hypotheses H1, H2, H3A, H3B, H4A, and H4B must be rejected. Growth in End-User Computing and Growth in IT Applications were both significantly related to the dependent variable 'Growth in Requirement of in-house IT professionals' thus evidencing some support for hypotheses H7 and H8 (Table 6).

Table 6. Correlation Analysis of Variables

Independent Variables		Hypothesis	Dependent variable: Growth in Requirement of in-house IT professionals (Delta_IT_in_House)			Accept/Reject Hypothesis
			Pearson Correlation	Sig. (2-tailed)	N	
DeltaOut	Growth in IT Outsourcing/offshoring	1	0.016	0.844	148	Reject
DeltaCloud	Growth in Cloud Servicing	2	-0.088	0.286	148	Reject
DeltaCOTSNonERP	Growth in COTS_NonERP packages	3a	0.004	0.960	148	Reject
DeltaCOTSERP	Growth in COTS_ERP packages	3b	-0.045	0.588	148	Reject
DeltaPropNonERP	Growth in Proprietary_NonERP packages	4a	0.052	0.532	148	Reject
DeltaPropERP	Growth in Proprietary_ERP packages	4b	-0.009	0.916	148	Reject
FGrowthEUC	Growth in End-User Computing	7	.362**	0.000**	148	SUPPORTED
FGrowthIT	Growth in IT Applications	8	.403**	0.000**	148	SUPPORTED

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis also revealed, as expected, that Growth in IT Outsourcing/offshoring, Growth in COTS_Non ERP packages, and Growth in Proprietary_Non ERP packages are positively correlated to their putative predictor variables. It can be argued that this is because IT outsourcing/offshoring is fairly matured business process and many COTS_non ERP packages are available from reliable vendors. Considering the governing factors, the growth in these items is justified. Similarly, since organizations need some customized applications, the positive growth in Proprietary_Non ERP packages can be justified. Growth in Cloud Servicing and Growth in COTS_ERP packages and Growth in Proprietary_ERP packages are negatively correlated. Since cloud services are not at a mature stage of the product life cycle and the costs of ERP packages are phenomenally high, the negative correlation is to be expected.

In the second part of the analysis the model for predicting Growth in End-User Computing (FGrowthEUC) using the two predictors - Drivers to involve End-Users in IT Function, Management Motivation to Support End-Users from Technical Components of IT, a regression analysis was employed. Tables 7, 8, and 9 show the results of the regression analysis. The analysis indicated a R-Square of 0.689 model, a significant F-statistic (F=160.955, df=2), and each of the predictors significant a p-values of .000, thus supporting hypotheses H5 and H6.

Table 7: Regression Analysis, Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

2\1	.830b	.689	.685	.786086928343201

a. Predictors: (Constant), Fdrivers, FMgtMotv

ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	198.919	2	99.459	160.955	.000c
	Residual	89.600	145	.618		
	Total	288.519	147			

a. Dependent Variable: FGrowthEUC
b. Predictors: (Constant), Fdrivers, FMgtMotv

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.784	.252		3.115	.002
	Fdrivers	.476	.065	.485	7.381	.000
	FMgtMotv	.392	.062	.413	6.281	.000

a. Dependent Variable: FGrowthEUC

In summary, of the 10 hypotheses, 4 were supported (H5, H6, H7, AND H8) and 6 were not supported (H1, H2, H3A, H3B, H4A, H4B). The ability of Drivers to involve End-Users in IT Function, and Management Motivation to Support End-Users from Technical Components of IT to predict Growth in End-User Computing (FGrowthEUC) is confirmed.

LIMITATIONS OF THE STUDY

As with any other study, this study also has a number of limitations that need to be discussed. First, there may be some biases in tabulating the list of variables pertaining to IT related issues. Although the literature was thoroughly reviewed and additional perspectives were obtained from IS academicians and managers, we cannot claim that these are the only variables that could be included. In factor analysis, the loading of an item on more than one construct could be due to high intercorrelations of the factors, the accidental exclusion of an unidentified factor, could result in items loading cleaner when the questionnaire is refined. There could be possibilities which are not mutually exclusive, but, it appears that some of the cross loading occurs on questions that relate to ease of use. Since ease of use is a known determinant of intention to use (Venkatesh and Davis, 1996) it is likely that refining the items to more clearly reflect the role of ease of use in the decision

process would add explanatory power. Therefore, such instrument may need several administrations before its construct validity can be ensured.

Thus, any interpretation of the findings must be made considering the selected set of variables, issues, and categories. The questionnaire survey involved people from various departments such as IS, administration, accounting/finance, production, etc. leading to some variance in meanings attributed to the questionnaire items. A balance among the number of respondents from each department could not be achieved. Furthermore, samples were collected from the manufacturing sector (automobile, computer hardware, pharmaceutical, telecommunication (hardware), and other) and service sector (banking, retail, hotels, computer software, construction, government, healthcare, insurance, technology, transportation, utilities, and other). Other types of organizations like airlines manufacturing, railway, chemicals, airlines operations, etc. are not included in the sample. Thus, any inferences based on the results might be restricted to the companies listed in the directory. The sample size is 148 which is moderate and approximately equally divided among manufacturing and service sectors.

SUGGESTIONS FOR FURTHER RESEARCH

This study provides several opportunities for future research. The results suggest that it might be useful to develop a number of comprehensive models. Thus, future research can extend this study to include additional factors such as organizational maturity, IS sophistication, etc.; and to test a variety of such factors. In studying this, future research may also employ more rigorous methodologies using longitudinal approaches and non-linear relationships. The need for further refinement of the survey is also a priority. While the current survey items were able to help advance this exploratory research, the number of factors that cross-loaded is a concern. Furthermore, with a broader sample and number of variables, a more generalized model can be developed. A comparative study between U.S. organizations and their counterparts in other nations may help the collaborations among them. In addition, a study on IT related issues on other industries in the United States -- i.e., airlines manufacturing, railway, chemicals, airlines operations, etc. -- could provide more generalized results.

IMPLICATIONS FOR PRACTICE

This study has demonstrated that organizations are, and after five years will still be, mitigating the excessive needs of in-house IT human resources partly by using COTS/ERP software, IT outsourcing/offshoring, cloud computing, and through End-user Computing. However, the growth over five years (2016 to 2021) in COTS/ERP software, IT outsourcing/offshoring, and cloud computing are practically insignificant. The equal usage in percentage of IT budget (in 2016 and 5 years from 2016) of IT outsourcing/offshoring, cloud computing, application service providers, and in-house development in the organizations will require employment of a relatively small number of in-house IT professionals for development of proprietary software, maintenance of IT applications and infrastructure. In addition, for applications where 43 percent of IT budget is allocated for IT cloud computing (including application service providers), relatively fewer IT professionals having skills in business processes are needed for implementation of readily supported IT application. Further, the End-users training requirements are to be met by IT professionals as (and when) the need arises. At the strategic level, senior level IT professionals are needed for formulating IT strategy and for advising organizations on the required IT architecture to meet the changing needs of the functional departments. The trend towards natural language processing will make IT applications simple and the availability of knowledge workers and growth in EUC is expected to replace IT professionals from operations and maintenance of software applications. In many cases the End-users will be able to develop most of the smaller one-time applications by themselves. Further, they will contribute equally with in-house IT professionals in selection and procurement of application software.

The current and future trends in the requirements of IT outsourcing/offshoring, cloud computing (including application service providers) will affect the curriculum of educational institutions. The IT curriculum must be redesigned equally to cater to the needs of IT skills in development and implementation needs of IT resources.

The organizations will rely on in-house IT department and on outsourcers, application service providers, and cloud computing. Therefore, vendor development and vendor relations are expected to be vital functions of an IT department (like they are in manufacturing and other service sectors of the business). The faster rate of obsolescence in technology will warrant time-to-time consultations for in-house IT professionals with external professionals in the field.

From the above, it can be argued that the current and future projected trends of usage of IT outsourcing/offshoring, cloud computing (including application service providers), and requirements of in-house IT human resources/End-users involved in IT activities has far reaching implications for organizations and educational institutions. Consequently, it will influence the government policies and tax structure. Lastly, it can be argued that this trend may lead to a new era pertaining to management of IT resources. Accordingly, this will open up tremendous opportunities for research.

CONCLUDING REMARKS

The main objective of this study was to arrive at a better understanding of the current and future trends in in-house IT human resources/End-users involved in IT activities and its implications for organizations in the United States.

Based on regression analysis, there are positively contributing factors that promote growth in IT applications leading us to believe that the organizations are motivated to use more IT applications in their business functions. These requirements of in-house IT human resources can be partly met by hiring and the rest through usage of COTS/ERP software, IT outsourcing/offshoring, cloud computing, and End-users Computing. The positive association of growth in End-users Computing along with management motivation to support EUC, plus drivers to help in EUC, justifies our claim. The result supports our model. The respondents also perceived a growth of 34.16 percent in IT human resources and 35.15 percent in EUC over a period of five years from the year 2016.

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QUESTIONNAIRE

DISTRIBUTION OF MANPOWER ENGAGED IN INFORMATION TECHNOLOGY APPLICATIONS.

B1. For the software your organization currently use, what percentage of the cost is contributed by application software packages from off-the-shelf vs. proprietary sources?

	Percentage
Off-the-shelf, non-ERP software	………….
Proprietary, non-ERP software	………….
Off-the-shelf, ERP software	………….
Proprietary, ERP software	………….

B2. In five years, what percentage of the cost is contributed by application software packages from off-the-shelf vs. proprietary sources?

	Percentage
Off-the-shelf, non-ERP software	………….
Proprietary, non-ERP software	………….
Off-the-shelf, ERP software	………….
Proprietary, ERP software	………….

C1. How much of your company's IT budget is allocated to buying and managing these different types of IT services currently? (in percentage)

	Percentage
In-house	………….
Outsourcing/offshoring	………….
Cloud computing	………….
Application service provider	………….

C2. How much of your company's IT budget do you think will be allocated to buying and managing these different types of IT services currently? (in percentage)

	Percentage
In-house	………….
Outsourcing/offshoring	………….

Cloud computing   …………
Application service provider   …………

E1. In the next 5 years how much will be the following human resource areas change in your opinion?

Increase (I)/Decrease (D)   %
Change
IT Employees   ……………………………   …………
End Users involved in IT Activities   ………………………….   …………

E2. You indicated that the percentage change in IT employees will be ……………
and the percentage change in end user Involvement in IT activities will
be …………….% over the next 5 years. How much did each of the following
factors contribute to your trend prediction?

	FIVE YEARS TREND
The backlog of information technology projects.	1 2 3 4 5 6 7
The evolution in hardware/ software.	1 2 3 4 5 6 7
User friendly software packages.	1 2 3 4 5 6 7
Little skill required to learn the operation/maintenance of packages.	1 2 3 4 5 6 7
Availability of knowledge workers.	1 2 3 4 5 6 7
Availability of reliable packages.	1 2 3 4 5 6 7
Increase in End User Computing	1 2 3 4 5 6 7
Willingness of top executive to advocate usage of information technology.	1 2 3 4 5 6 7
Willingness to change.	1 2 3 4 5 6 7
Growth in usage of information technology.	1 2 3 4 5 6 7
Availability of skilled end-users to develop and operate packages	1 2 3 4 5 6 7
End-users are skilled in computer literacy	1 2 3 4 5 6 7
Availability of user-friendly tools for developing and maintaining applications	1 2 3 4 5 6 7
Automation in application software development	1 2 3 4 5 6 7

** IT professionals are employees who are responsible for mainly IT activities such as planning, design, construction, and maintenance of IT resources

End users are employees who are responsible mainly for functional activities (operations, accounting, marketing, human resources, etc.) and uses IT resources as a tool to accomplish their functional duties.

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