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Towards virtualization: A competitive business continuity

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The ultimate goal of all businesses no matter in which sectors they operate is to maintain their profitability and growth. There is a relationship among the capital, investment, and the personnel in order to achieve objectives for the performance of the organizational systems and it must be maintained without any deterioration. Companies have a chance to compete with other firms in the national and international arena through this relationship, and of course within the limits specified by their capitals. The level of success targeted with the suitable investments, qualified personnel and the capabilities of today's technology is possible for today, at least with a fixed capital for a certain period of time in this relationship. Companies can provide many benefits by using and managing the capabilities offered by virtualization. In this study, we present the results of a survey conducted in 100 small and medium-sized companies in the transportation and services sectors located in Izmir (Turkey). The analysis of this survey will enable a better understanding of virtualization services and motivate especially Information Technologies (IT) staff as a detailed framework for the companies working in different industrial sectors.

Key words: Virtualization, outsourcing, cloud computing, small and medium-sized businesses.

INTRODUCTION

Business problems are inevitable and the companies can face with difficulties that block and reduce their activities to maintain, regardless of their size, number of employees and industrial sectors. However, there are some possible solutions that will handle your business. Outsourcing of required business processes that are ready to be used by all sectors is now changing the way how to run organizational business. Unfortunately, the biggest impact in the future will be an inevitable decline in the company's information systems staff. Companies transfer some of their activity-based applications and services to the other companies that specialize in that field. So that, organizations get rid of unnecessary units and become more lean and flexible through the outsourcing issue. This will both cut costs and accelerate decision-making processes and of course will facilitate the company's focus on the main business objectives.

Effects of globalization and increasing competition motivate companies to produce more quality, cheaper and faster. Therefore, organizations transfer their businesses that they did not use their talents and focus

on their core competencies, in order to protect their competitive advantages in the market. Thanks to the emerging telecommunications technologies, there is a continuous communication between employees even if they are not in the same place. As a result, new structures such as virtualization and their significant branches grid computing and cloud computing have emerged.

In this study, we will seek answers about how small and mid-sized companies can improve their IT infrastructure to increase performance and make overall businesses easier, more flexible and effective. In the last 5 - 10 years, the idea of virtualization and its business benefits have spread to virtually every different aspects of Information Technologies. Today, virtualization is a hot topic in IT, by consolidating servers, workstations, storage devices, applications and the network itself.

Small and medium-sized businesses (SMBs) are economically and socially an element of balance in our country as it is in the whole world. SMBs of course have some problems to apply necessary financial methods, functional problems like technology transfer, benefit from

high-level professional management, and strategy development. It is very important to resolve all these issues to sustain their economic interests. SMBs have been defined by the Ministry of Industry and Trade (in Turkey) through the regulation published in 2005 and summarized in Table 1.

Today's challenging business environment forces different types of organizations to allocate a certain amount of capital for their IT facilities that manage nearly everything within the organization and conduct business activities. This brings important requirements for information systems and raises a great challenge to vendors of hardware and software products in the market. Owners and the managers of SMBs try to afford these expenses related to specific commercial applications and user services.

They should decide if these expenses are worth to pay. Virtualization can be combined to optimize availability of required services while reducing the total cost of ownership, right-sizing of resources, eliminating legacy hardware and software, and enhancing flexibility. An article published in (Scientific Subjects, 2009) stated that virtualization can respond quickly and effectively to the demands of high- throughput for the organizational applications. It also described many other virtualization features such as, the re-allocation of the required resources between the virtual machines, the load distribution by creating new virtual machines, transferring network devices, processor, memory and storage pools to the required applications, allocating faster servers and storage systems into high-demand processes.

This paper has the following contributions:

1. A novel and practical analysis for virtualization studies in SMBs located in Izmir (Turkey),
2. A real framework for how and why SMBs adapt outsourcing types for their IT systems,
3. The effects of e-marketing and e-business activities through virtualization,
4. A comprehensive literature review on virtualization.

PREVIOUS STUDIES

If we categorize the previous studies according to the general issues highlighted, we may have the following different topics:

1. Automated IT systems and their benefits
2. Development in telecommunications and transmission technologies
3. Virtualization concepts and principles
4. Business competitiveness
5. Other services

The biggest expectation of the companies for the virtualization is the automation that it brings into their

Table 1. Official small and medium-sized businesses definition.

Organization type	Number of employees <	Annual balance (Million Turkish Lira-TL)
Medium sized	250	25
Small sized	50	5
Micro sized	10	1

Source: http://www.kobilerim.com.

current systems. No matter which area the companies operate, an automation of information technology is certain to provide a huge benefit. Most of the studies in this area show how the organizational systems benefit of hardware and software developments in the field. The only problem is the cost of these services. Jing et al. (2007) argued a core infrastructure how to develop systems with a cost as low as possible. Agarwala et al. (2008) presented a new software tool that automated the costing and chargeback of IT processes and provided a flexible framework for the organizational cost. Rodríguez et al. (2008) researched that each application required different hardware and software. They explained that dynamic features in a Virtual Machine (VM) environment presented a challenge how to assign them properly according to the certain optimization criteria and physical resources. They also tried to assess how an automated resource management could be handled. Liu et al. (2009) developed a model to explore the potential relationships among IT resources, knowledge management and e-business performance.

They conducted an empirical study with data collected from modem service firms and indicated that knowledge management played a significant role in the firm's e-business performance. Their findings showed that information system integration (ISI) enabling organizations to share and apply the knowledge of their people was the foundation of e- business success. A highly effective common culture, namely "Creative R and D" given by Newman (2009) combines Customer-focused, Risk-tolerant, Entrepreneurial, Align-ment with strategy, Technology and scientific excellence, Innovative, Virtual organization (Collaboration) and Execution elements. Newman studied on the framework of this common culture that could be applied successfully in various companies and industries. Greenhalgh et al. (2009) presented new classes of network architectures and network functionalities for flexibility and low cost since recent advances in CPU power, memory and network connectivity had turned current personal computer systems into a powerful network platform.

The existing network environment and telecommunications capability should not be overlooked for an overall virtualization. In many of the previous studies, the developments in the communications links have focused on the influence of virtual environments. Bodendorf and

Swain (2001) examined the role of virtual universities in engineering education since they considered that "virtualization" would be one of the ways to find solutions for the challenges in traditional higher education. Bavier et al. (2006) described a virtual network infrastructure with the protocols and services required in a realistic environment and this gave an opportunity to researchers to evaluate their networking ideas technically like a test bed. Berde et al. (2009) proposed a framework to overcome the limits of current telecommunications infrastructures in large-scale grid environments including enterprises, companies, or collaborative business organizations.

When the question of what type of services in the Internet could be purchased, virtualization became reality. We knew that organizational adoption of IT facilitated virtualization together with the communication technology to manage business interactions and operations with customers, suppliers and employees. Liu et al. (2008) researched the benefits, external influences and organizational capabilities while using virtualization in Busines-to-Business (B2B) organizations. Later, Li et al. (2009) examined the relationships among business orientation, knowledge creation and firm performance by using a survey data. They analysed the direct and indirect effects of the business orientation on firm performance and knowledge creation process among the different organizations.

The rapid adoption of Internet technologies has driven a process of virtualization (mainly in the supply channels) replacing current work practices across organizations. Ho et al. (2003) presented three key elements of supply chain virtualization which are the formation of virtual trading communities, the emergence of virtual knowledge communities, and the relocation and integration of inter-organizational business processes in the Internet. The transformations and consequences of virtualization has propelled a structural change in different business relationships and accelerated internationalization of small and medium-sized enterprises. Banniza et al. (2009) discussed a research program for "Future Internet" which can be named as "virtual environment" and tried to find innovative solutions in architectural design, virtualization, and connectivity issues in this new type of networking by describing technical requirements for new business opportunities.

Virtualization supports companies in globally distributed environments together with the improved information and communication technologies. However, these technologies sometimes do not perform as expected, so that the investment does not generate the expected added value. (Fiedler and Gallenkamp, 2008) reviewed the status of current research studies about the virtualization of communications for how to support companies better in exploiting their economical potential. Kusic et al. (2009) proposed an approach to account for the costs of virtual machines like servers, workstations, and data storages.

Hutt et al. (2009) provided a broad overview of virtualization technology and emphasized the importance of a careful planning for specific needs. Their study covered both technical and usability considerations and concluded with a discussion of potential enterprise impacts. Loveland et al. (2008) evaluated how virtualization technologies and techniques could augment and amplify traditional approaches (such as active/active and active/passive) to virtualized environments.

Automation gained through virtualization, flexibility and the cost efficiency actually provides that the companies are able to do business more easily in the international arena. (Camison and Villar, 2009) provided internal drivers motivating firms to select cooperative internationalization processes. They examined the direct and indirect effects of ability for cooperative internationalization and found out that capabilities would be a positive predictor by the adoption of a differentiating competitive strategy. Workman (2007) examined the effects of virtualization on social influences and organizational performance. He found nonlinear relationships between virtualization and cohesion, as well as virtualization and conflict.

Task-relationship orientation and social-technical skills were also found to interact with virtualization on performance. (Philips and Wright, 2009) studied on the influences of flexibility on organizational effectiveness in the e-business environments and organizations' ability to respond to unpredicted changes in the market. McIvor et al. (2009) assessed the applicability of a number of performance management techniques in the outsourcing process since they could be employed to remove inefficiencies from processes both prior to outsourcing and during the outsourcing.

Other activities such as grid and cloud computing used currently for the virtualization purposes have been given in the next section. The advantages of virtualization should be balanced with the security risks associated with these newly acquired organizational capabilities. Personnel in charge (executives, managers, network and system administrators) can face many different security challenges in order to protect their IT resources. Therefore, it is necessary to consider security mechanisms for both hardware and software (physical and virtual) systems. van Cleeff et al. (2009) performed a detailed literature review on the security effects of virtualization and found that the core virtualization technology had a clear positive effect on availability while the effect on confidentiality and integrity was less positive.

VIRTUALIZATION PROCESS

It is very important to evaluate the overall impact, challenges and requirements of the operational issues while implementing any type of virtualization that adds certain abstraction layers like a middleware into the
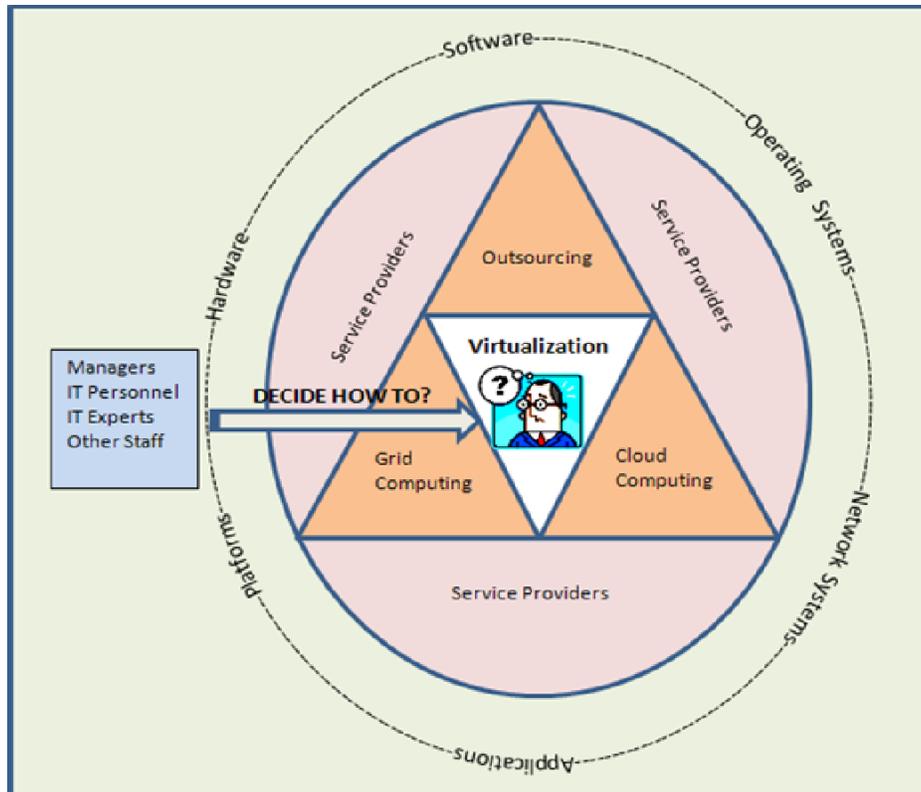
Figure 1. Applicable virtualization framework model.

organizational networking environment. So that each layer of the desired virtual services works properly with other layers below or above it. We can name these layers as the virtualization in the software and hardware, platform, operating system, applications, network and storage layers and finally the required services. But there should also be a proper fault and configuration management activity for different corporate devices used in virtualization. Rudolph (2009) addressed that virtualization technology offered a practical means for the widespread deployment of the necessary middleware and pointed out that smart phones would be the best candidate as the platform of pervasive computing.

BUSINESS EFFECTS

The best way to obtain the maximum organizational benefits, regardless of the type of virtualization, is to treat the required virtual devices as the rest of the environment. The environment should also provide the necessary management and configuration tools. Figure 1 shows the different objects (available products) used in a virtualization implementation. It also summarizes an applicable framework of how companies can easily step into the virtualization world and handle their e-marketing issues through these systems.

Personnel responsibility shifts from the level of experts to the automated management tools. Challenges change according to the organizational expectations of virtualization. The new opportunities we have gained with virtualization are rapidly increasing and thanks to IT and the Internet, they always bring different services for the organizations. Of course, the newer services offered by virtualization cause more complexity in the business world. Business managers face different levels of complexity that threaten their stability of existing services.

GRID COMPUT NG

Grid computing emerged as a new field, distinguished from traditional distributed networks by its ability of large-scale resource sharing. Grid computing allows large numbers of hardware components, such as servers (processors and memories) and disk drives to act as a single device, pooling their capacity and allocating it automatically to different jobs. Web services standardize the interfaces between applications. They have a very popular interest in many distributed applications from the point of academic view. However, the dynamic and complex structure of grid systems challenge significant security issues that require new technical approaches. Network access should be controlled between the grid

users and the Internet. The organizational access control policy is specified for the remote business partners and required devices are determined to implement this policy Ercan et al. (2008).

CLOUD COMPUTING AS AN EXTENSION TO TODAY'S VIRTUALIZATION CONCEPT

Cloud computing is an important term in the concept of new IT. It is a kind of scalable computing and use virtualized resources that can be shared by users. Users do not need background knowledge of the services. A user on the Internet can communicate with many servers (exchanging information with each other) used by the cloud (Hayes, 2008) . It contains all the new technology trends (broadband internet, fast connection and virtualization). Senior people in charge of their business challenge how to redesign their IT operations to reallocate their limited Internal resources to support their corporate priorities. This is driving them to rely on the third-party services to increase their in-house capabilities and better satisfy the needs of their end-users, as well as their customers and strategic partners. In order to support the maximum number of user and elastic service with the minimum resource, the Internet service providers invented the cloud computing. Qian et al. (2009) introduced the concept, history, pros and cons of cloud computing as well as the value chain and standardization effort.

Cloud computing becomes an adoptable technology for many of the organizations with its dynamic scalability and usage of virtualized resources as a service through the Internet. One of its significant impacts will probably be on the educational environment in the future. Cloud computing is an excellent alternative for educational institutions which are especially under budget shortage in order to operate their information systems effectively without spending more capital for the computers and network devices. Universities take advantage of available cloud-based applications offered by service providers and enable their own users/students to perform business and academic tasks (Ercan, 2010).

PROPOSED MODEL

Applications we considered as activity-based programs and practices which are in accordance with SMBs' own structures are served by the IT firms in the city of activity, unlike other services provided from Internet, such as hardware, software (office programs, email programs for Windows and Linux environment), operating systems, network connections and platforms as global services. It is considered that these services will either be purchased from the real owners of the services by a direct or indirect outsourcing or be provided from the cloud computing with

some certain subscription fees. Another way is to use the programs owned by the company and give a related training to the working staff. These preferences may vary according to the number of application/software licenses, the scope of services and the maintenance services after purchase. We tried to model that small and medium-sized companies operating in a particular city and in different industrial areas, always quest about the competency of their information systems in relation to the current market status, sufficient luck of competition and the current technology opportunities.

A framework for this relationship is shown in Figure 2. This framework or namely "Business Activity Ladder (BAL)" represents how businesses adopt new working practices and helps identify their requirements of hardware (servers and user devices) and software. From the perspective of business world, in real life, as a natural result of this structure, company resources increase on a regular basis. While a personal need initially appears at the level of employees, later it can become an organizational need of the company to provide it through outsourcing. Of course, the most extreme point is to leave the management issue to the professional experts in service provider companies, due to the increasing diversity of required services.

We have planned to do a special research of how these systems can adapt a suitable form of virtualization for small and medium- sized companies representing the majority of the world of business. All of these works have been based on our experiences and knowledge acquired while previously working on cloud computing and grid networking, and by adding the survey results we conducted in the beginning of this year.

CASE STUDY

An experimental study based on filling the survey papers according to the rankings of company information technologies, our proposed virtualization framework in Figure 1, and Business Activity ladder in Figure 2, will give the possibility of evaluating company employees on the subject of IT understanding and adapting. Our goal was to study on the firms in the city of Izmir about how they utilized on the Internet according to their industrial sectors, which applications they used and what other applications they might require. We worked on the real data collected by a survey and obtained from Internet. We would share the results with Aegean Region Chamber of Industry and the Information technology companies in the city. We conducted the survey with 168 IT professionals or managers working in 100 different small and medium sized companies located in Izmir, Turkey. Our results showed that these companies achieved very important benefits from virtualization. Virtualization improved especially IT employees' service quality. However, the more services are acquired by
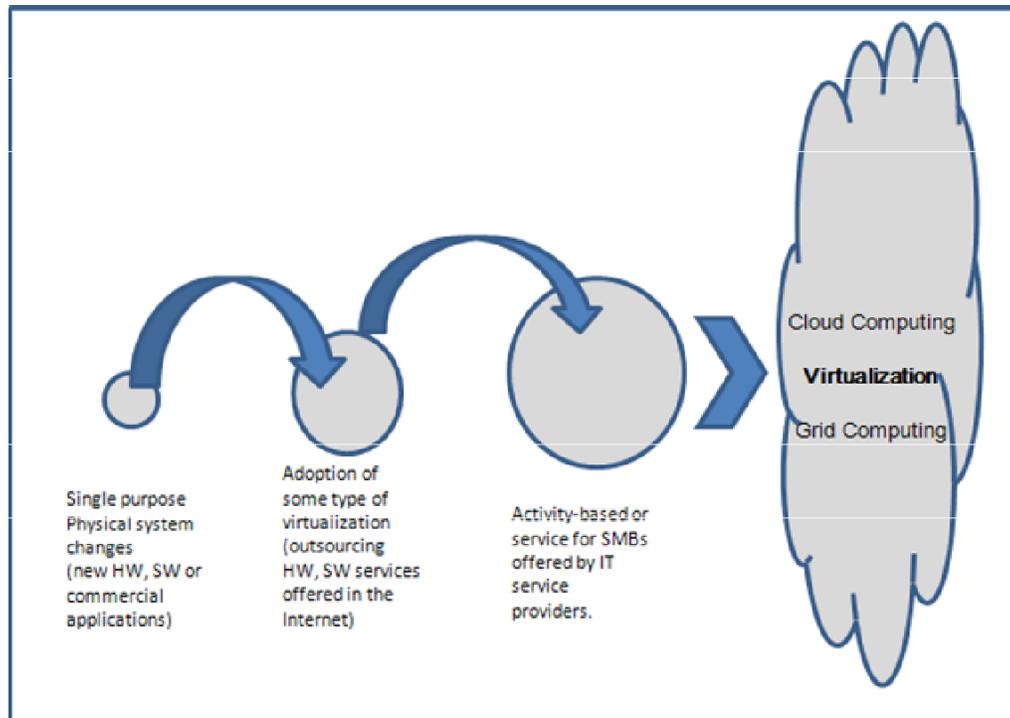
Figure 2. Business activity ladder.

virtualization, the more complexity it brings into the organization.

METHODS

The main sampling frame of this research consisted of 168 employees working in 100 different firms. While determining these firms, their being in different industrial sectors, their accessibility, and capabilities of utilizing the networking facilities and convenience of data collection became our primary concern.

By using the official web site of the Aegean Region Chamber of Industry, we determined some industrial sectors we considered as they were using information systems more intensely than the other existing sectors. Since the total number of firms was 4455 when we did not use the drop down menus shown in Figure 3 (Industrial sector for 1, capital status for 2, and number of employees for 3), we selected only transportation and services industries which gave a total of 115 company names. We used the choice of "ALL" in box 2 for the capital status, and the choice of "5 - 24 and 25 - 49" in box 3 for the number of employees. So that instead of using the total number of 115, we decided to use 100 firms. The number of questionnaires were sent by e -mail or delivered by our students who are trainees/interns for that period of time. The number of valid responses was 168. This work lasted in 3 months as of October - December period in 2009. Data collection and evaluation phase of the study was carried out with survey results in the following 3 months. The questionnaire consists of three parts including different numbers of items in each part. The first part of the survey was composed of 8 questions in determining the firms' demographic structure which is employee status (Manager, IT personnel, IT expert, other staff), the second part of the survey consisted of 12 questions in order to explain how knowledgeable are these people about virtualization and how they approach the virtual services that

will be provided. The third part consisted of 20 questions and constructed to describe existing virtual capabilities and what else they may require in the future based on the framework was provided in Figure 1.

ANALYSIS AND FINDINGS

Our study yielded these findings: (1) Service planning and management were not so clear in virtualized systems. The performance problems (fast workflow in the company through the internet, utility of different services and applications) were unknown, (2) Necessary level of personnel training to use virtualized tools and services should have been handled, (3) Flexibility and cost savings that the virtualization has brought 2. The author surveyed about 168 IT experts and business managers (54% were IT experts, 34% managers, 5 and 12% for IT staff and other personnel) on what their organizations think about virtualization and cloud computing. Some of the questions belong to how and when they plan to deploy these technologies. While the 76.9% of the 26 managers who responded to the survey consider that virtualization is very important for businesses, the rate of 65 qualified IT staff who specialize in specific subjects is 81.5%. However, the other 43 IT staff leaded by their chiefs (IT experts and administrators) and corresponding to a portion 20.9% think that virtualization opportunities very important and remaining 69.8% find that the idea important. Other 34 staff members have no idea about

Figure 3. Official web site of aegean region chamber of industry.

Table 2. How employees evaluate virtualization.

Employees in the firms	Number	Very important (%)	mportant (%)	No idea (%)	Not important (%)
Manager	26	20 (76.9)	6 (23.1)		
IT experts	65	53 (81.5)	12 (18.5)		
IT Staff	43	9 (20.9)	30 (69.8)	4 (9.3)	
Other personnel	34			25 (73.5)	9 (26.5)

virtualization (Table 2).

However, respondents are more knowledgeable for specific questions in the third part of the survey such as software, hardware, custom applications, e-mail system and internet connection within the company. Nevertheless, the 37% of the participants consider that their institutions do nothing about virtualization, while 49% use it in some applications and 15% are in a planning stage for solution reviews and strategy development activities. Even the 16% of IT professionals state that their IT environment is completely virtual while 54% state that it is partially virtual.

Some of the respondents also state that the cloud

computing technology is not used widely yet and security concerns due to the usage of mobile and wireless technologies should have been taken into consideration. However, the percentage of the people who think that this situation will provide financial gain in the hardware infrastructure is 38%, the number of personnel who predict a decrease in the number of IT personnel and administrative structures of the company is around 35% due to the services are being outsourced. Some 28% of those attending this survey consider that these services are provided since the company itself is not already interested or there is no staff in order to to operate the required services. Table 3 shows some sample questions

Table 3. Cloud computing sample questions.

Questions employees in the firms	Yes/No	Multiple choice
cloud computing is a new shift in IT deployment	X	
current virtual technologies are not appropriate for our firm	X	
adaptation of cloud computing will take years to be accepted	X	
currently using cloud computing	X	
still researching	X	
plan to use within the period of xxxx		X
familiar with the technology		X
client systems mostly use		X
server virtualization		X
Increasing data growth requires cloud services	X	

related with cloud technology.

Perhaps the most important points of our survey in each company were the number of information systems personnel. Naturally, we have identified these numbers that depend on the size of the company as "least" for one person, "minimum" for 2 - 3 people, "medium" for 4 - 5, and "considerable" for six or more IT staff. I have evaluated research results for both staff-levels and the different level of applications (HW/SW/OS, network/ internet, activity-based applications and outsourcing) in the "Business Activity Ladder" depicted in Figure 2 and obtained Figure 4.

Our first attention when we look at these graphics is the value of 100% and it gets the best value in all services in the companies that have only one IT staff, no matter whether it is naturally being outsourced or the most basic IT services. When the number of IT staff who work, is minimum, the ratio how much they are busy with the network and the Internet is 74%, while the level of interest in software and hardware is at 46%. This ratio is 20% and the same for outsourcing and activity-based applications. Although, it has taken into consideration that the same IT staff can deal with these two different areas of services, roughly while one person out of three IT employees works for the low level basic tasks like HW, SW and OS, this means that other two are being specialized in network, Internet or other applications.

When the number of IT personnel becomes medium and considerable, we see that especially outsourcing according to the activity-based applications, and network/ Internet according to the basic works increase by half, although, they are different services (outsourcing: 50%, activity-based applications: 25%, network: 45%, HW / SW: 27%) . When we consider these values of outsourcing and activity activity-based applications which are the last rings of Business activity ladder (Figure 4), it can be said that cloud computing as a branch of virtualization depending on the current organizational requirements has started for the company. Indeed virtualization can resolve financial difficulties to buy application licenses and to train their own staffs that

require individual expertise.

DISCUSS ON

When we look at the study in general, the question of whether or not the suitability of selected industries is suitable for an objective survey may draw the readers' attention. However, these two sectors which are transportation and services are the industrial groups of reflecting their modernity with their areas of work when compared to the other sectors and really need to be promoted through the internet. Another issue in the survey is a matter of competence of information systems personnel worked in each organization. The subject of being sufficiently specialized for IT staff means that they understand the technological developments and follow the recent developments in their own areas. This situation is very important for the terms of research results. If we assume that the new cloud computing, especially with its recent developments in the field of IT, grows increasingly, the common understanding and adaptation of the services will bring a surplus value in the organizations.

Conclusion

Virtualization brings considerable benefits into the different business areas of SMBs if they perceive the use of their knowledge as a beginning point and replace it with the required automated or outsourced processes. Overall IT management gains importance because of increasing number of HW, SW tools and operational applications in the organization. The skills of employees change for the effective use of virtualization. Even by filling a detailed questionnaire in this case study, many of the employees become more informed about virtualization and cloud computing technologies. They will come to IT staff and ask about these technology packages and how they can benefit to solve some of their operational problems. New management tools provide a

	Least	Minimum	Medium	Considerable
Network/ Internet	100	74	68	45
HW, SW, OS	100	46	50	27

	Least	Minimum	Medium	Considerable
Outsourcing		20	50	70
Activity-based applications	100	20	25	46
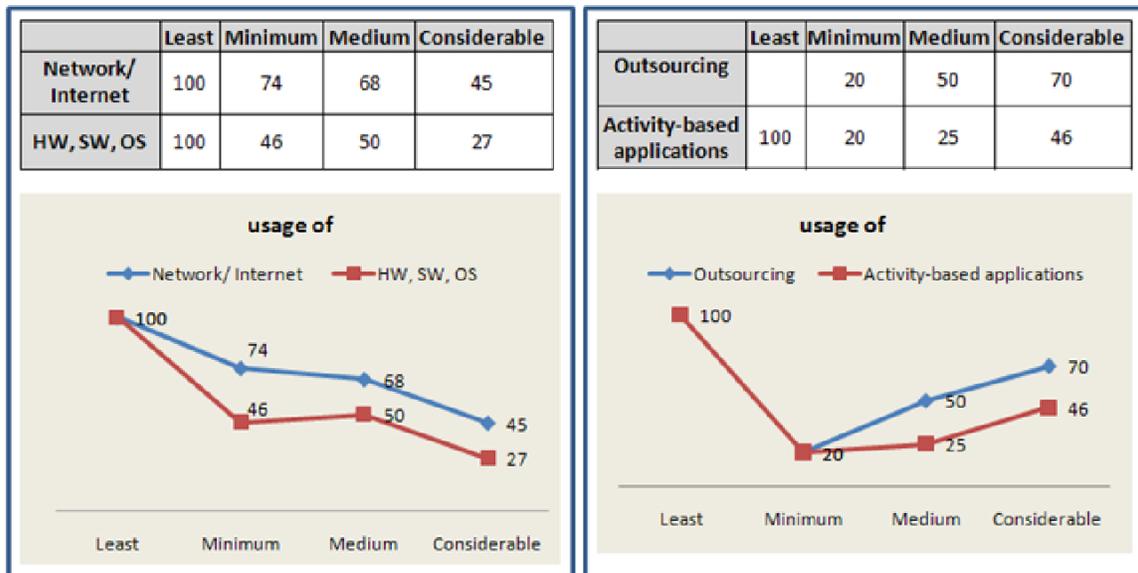
Figure 4. Analysis of business activities versus IT staff.

high performance that will increase the company's competition chance in the market since necessary tools make processes real and give an opportunity to automate and integrate virtualization. The most significant finding of this study is that learning, adapting and trying to see the benefits of virtualization by using at least one of the current services like outsourcing or cloud computing. Besides, the organizational culture and mainly the effect of leadership in the firms have a beneficial impact on the idea of virtualization. The results of the survey also helps to determine firm's organizational cultural profile. Given this fact, leaders in the firms should react well against the pressure of successful marketing by being ready to adapt the technology and do their business well.

Cloud computing for SMBs will be the main service type of work in the very near future. Although, midsize firms have many things in common with large organizations, they differ in terms of budget and resources, currently the financial status of these small and medium sized companies is still limited to afford resources (personnel, workplace expenses, IT) plus new virtual services. However, many of the current services handled by the IT staff are critical to the adaption of cloud computing. Survey results show what "cloud computing" and "virtualization" can do for a business. This article can enable many administration and IT staff to take this type of investment serious and add them into their future plans. It also encourages small and medium size business owners to examine some cloud based applications offered through the internet.

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