

Managing IT Departments in Higher Education Institutes: Coping with the Exponentially Growing Needs and Expectations

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Abstract—Information technology is changing rapidly and the users' expectations are also growing. Dealing with these changes in information technology, while satisfying the users' needs and expectations is a big challenge. IT managers need to explore new mechanisms/strategies to enable them to cope with such challenges.

The objectives of this research are to identify the significant challenges that might face IT managers in higher education institutes in the face of the high and ever growing customer expectations and to propose possible solutions to cope with such high-speed changes in information technology.

To achieve these objectives, interviews with the IT professionals from different higher education institutes in Oman were conducted. In addition, documentation (printed and online) related to these institutions were studied and an intensive literature review of published work was examined.

The findings of this research are expected to give a better understanding of the challenges that might face the IT managers at higher education institutes. This acquired understanding is expected to highlight the importance of being adaptable and fast in keeping up with the ever-growing technological changes. Moreover, adopting different tools and technologies could assist IT managers in developing their organisations' IT policies and strategies.

Keywords—Information technology, IT rapid changes, CIO roles, challenges, IT managers, coping mechanisms, users' expectations.

I. INTRODUCTION

INFORMATION technology is described as being one of the primary drivers of change in the way people work, seek information, communicate, and entertain themselves [1]. The rapid changes in Information and Communication Technology produce multiple challenges for IT managers in coping with these changes. From the time they discover that they are behind until they reach the stage where they want to put a strategy into action can be long, so that IT solution could become 'old' before ever actually being able to take any action. To put it another way, "a new IT solution can even become obsolete before its initial use in production" [2] and this is because of the rapid changes in technology. However, this situation brings with it a fundamental question, which is 'how to manage technological change successfully?'

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The rapid changes in technology and the growing users' expectations demand that IT managers to be aware of the coping mechanisms in order to ensure that the organization isn't left behind. According to Lederer (2001) [3], the coping mechanisms comprise five categories: education and training, vendor support, endurance, internal procedures, and consultant support. In order to cover these areas, IT managers will probably face many challenges. In fact, IT managers cannot be experts on all emerging ITs. Hence, how they can cope with such changes?

In order to avoid the risk of organization failure IT managers should understand, plan, and control the impact of changing IT on their organizations [4]. In fact, it is difficult to imagine a business today that does not in some way rely on IT as a foundation for its success [3]. Specifically, a higher education institute will face a major challenge if the IT manager does not have the necessary skills and ability to manage a rapidly changing IT [5].

This research aims to identify and highlight the different challenges that the IT managers are currently facing. Furthermore, it will discuss a variety of coping mechanisms for minimizing the risks. The research aims to answer three fundamental questions:

- What are the problems and challenges faced by IT managers in modern organizations, and especially in higher education institutes?
- Are the new organizations facing the same problems as the older ones? If not, what is the difference in nature of the problems faced in each type of organizations, and why do these differences occur?
- How can such challenges/obstacles be better mitigated?

The rest of this paper is laid out as follows. The following part is a literature review which is divided into three main subjects: firstly, the role and responsibilities of IT managers; secondly, the challenges and obstacles IT managers might face; and thirdly, the different kinds of mechanism for coping with the challenges due to the fast-changing IT tools and technologies. This is followed by a description of the research methodologies implemented in this research. The research findings are then discussed, and the contributions and conclusion are presented at the end of the paper.

II. LITERATURE REVIEW AND RELATED RESEARCH

In order to succeed every manager must become a *tech-trender*. A *tech-trender* manager tracks technology changes

and builds technology awareness and learning into their regular work schedules. Indeed, companies and institutes that refuse to evolve with technological changes do so at the risk of their survival. Xerox, a major high tech pioneer, has been flirting with bankruptcy because it stuck with its laser-based copier business rather than restructuring itself to take advantage of Web technology. Other companies like Charles Schwab have been able to successfully harness the Internet [6].

An organization's success depends on its readiness to cope with the rapidity of technology changes. Blended aspects, which include the ICT infrastructure, people, process, and business environment, should be managed [1]. In order to cope with these changes, firstly, the managers should know their roles and responsibilities. Moreover, they have to be aware of the problems they may face as well as how to mitigate them. The following sections of the literature highlight these issues and how to deal with them.

A. Roles and Responsibilities of IT Managers

With the rapid changes in Information Technology (IT) and their ever-growing adoption in business processes, the IT managers' roles and responsibilities have also been changing. It was found that there are two versions of the roles: an executive-level manager focused on the firm's strategy and processes, and a technical manager focused on minimizing costs by rationalizing and leveraging the existing Information Systems (IS) infrastructure. Following the development of the roles and responsibilities of IT managers from the early days until now reveals that in 1980s they were "behind-the-scenes technicians". Then in the 1990s, the perception of IT managers changed to "innovators attempting to climb the corporate ladder". Following this at least some IT managers were viewed as top level executives responsible for managing and leveraging technology to provide value to the business.

What is more Chun and Mooney (2009) [7] found that the roles and responsibilities of IT managers fall into four natural categories: 'Triage nurse/fire-fighter' - these are IT managers or executives whose main goal is to fix urgent IS-related problems (e.g., technical bugs, failed systems and disrupted processing). The second category is 'Landscape cultivator' - these IT managers have the primary responsibility for technical improvement and rationalization of the firm's data by maintaining and integrating existing applications and processes. Thirdly, 'Opportunity seeker' - the IT managers in this category are opportunity seekers whose main goal is to improve business processes within and outside the firm. Finally, 'Innovator/creator' - these IT managers primarily focused on innovation and new opportunities, implementing new 'IS' across the corporation.

The successful higher education IT manager in the 21st century must be a full-spectrum contributor to the development and management of business strategies and directions within the IT managers' executive management team. Failure to be accepted by the executive management team minimizes the IT managers' influence and places the IT department in a poor position [8].

B. Challenges and Obstacles

The rapid changes of technology turn out to be a challenge for many businesses and industries [1]. The change is not only rapid, but is also expected to continue into the future [3]. Therefore IT departments and their IT managers may face a communication and action gap in their institutes and in their leadership. This gap causes inefficiency between the departments who use the technology services, thus eroding interdepartmental relationships [5].

Recent surveys have supported the fact that changing IT is an issue for many organizations. A survey of 50 IT managers in the U.S. indicated that rapidly changing technologies were their second biggest issue. Another survey of 364 North American IT managers indicated that integrating systems, capitalizing on advances in IT, and updating obsolete systems were all top management issues. A third survey of 43 senior U.S. executives indicated that keeping pace with changing technologies was a major issue [3].

New IT brings uncertainty about implementation, application, and support for the new IT itself. It thus produces such problems as delays, cost overruns, and unexpected work in IT projects [3], and it takes time to design effective learning materials and to put technology systems in place [9]. As a consequence, the US federal government spends tens of billions of dollars annually on IT [10].

Like IT managers in higher education institutions, IT managers in other organizations face many challenges as well. In every advanced society the problems of higher education are problems associated with growth. These problems arise in every aspect of higher education, in its finance, in its administration, in its recruitment and training - growth has its impact on every form of activity and manifestation of higher education [11].

A primary challenge or problem faced by higher education institutes, as Sarker (2010) states, is the lack of investment in technology-based learning, which presents a significant barrier to universities trying to cope with new technologies and compete in changing markets [12]. What is more, Kipsoi (2012) adds to these challenges the lack of technical, administrative and institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change [13]. Other challenges concern the need for old systems to be upgraded to keep pace with the rapid growth of science and technology [14].

Basically, to overcome these challenges, Singh [14] states that "The shift can occur only through a systematic approach to change as also well as the development of an institution's human resources, and by networking the system through information and communication technology".

C. Mechanisms for Coping with Challenges

Technological changes increase people's interest in the discovery of knowledge and developing new ideas, and this creates a healthy environment for future generations. However, the IT changes must be properly managed [1]. That is, organizations must have the ability to manage changes. Due to the challenges that IT managers face, several different

studies have been conducted on this subject (see Table I). They found that the organizations address the problems through the use of what is called “coping mechanisms”. There are many categories of coping mechanisms, for example Lederer (2001) investigated the following: “Education and Training, Vendor Support, Endurance, Internal Procedures, and Consultant Support” [3]. The choice of coping mechanisms depends on the nature of the problem and the challenges faced by the IT managers and the environment, and these choices can lead to the success or failure of the organization [3].

Education and training is the most used of these coping mechanisms in IT departments. The continuous education and training of IT professionals, as well other faculties who are working in the organization, is a very important coping mechanism because they must have the current critical skills and required knowledge. The second most used coping mechanisms is ‘vendor support’, with which organizations attempt to avoid or minimize problems with changing IT by obtaining support from the vendor of the IT. Vendors provide assistance (IT customization, problem solving, enhancement, and interfacing). Endurance, Internal Procedures, and Consultant Support are the least used coping mechanisms as they seem to cause more problems than they solve [3].

According to Galbraith [15], organizations try to cope in either of two ways: by reducing the need for information processing or by increasing the capacity to process information. Moreover, they might use external resources such as consultants, vendors, or users from other companies to help reduce their own need to understand new IT. Perhaps making use of external resources (i.e. IT vendors), will help the organization to focus on the core of their business. In education institutes many IT departments outsource their information technology-related services to a third party vendor. Cloud computing is the latest trend to outsource some or complete IT operations to run a business from the public cloud that provides a flexible and highly scalable technology platform for an organization's business operations [16]. Further, they might provide educational courses for their staff about new IT. The effect of the use of the external resources and educational courses would be to reduce the exceptions – the delays, overruns, and unexpected work. Another study conducted by Benamati and Lederer (2001) found that the most used coping mechanisms to address problems due to rapid IT change are “Read to keep informed of available new IT” and the second most used is “Inform IS Professionals of the benefit of new IT” [17]. This demonstrates the importance of IT managers understanding and gaining a wide knowledge of new IT.

In fact, many organizations nowadays come up with new strategies to cope with technological changes, such as: the conventional approach, outsourcing, ‘Model-of-change’ management, Three-E Strategy, The Gartner Hype Cycle's Priority Matrix, Change, Adapting, Learning Model (CALM), Cultural Theory, and the Unified Model of Technology Resistance and many others as shown in Table I. However,

none of these tools address the issue of managing technological change problems properly [1].

TABLE I
COPING MECHANISMS

No	Paper Title	Coping Mechanism	Description
1	Coping with the Rapidity of Information Technology Changes—A Comparison Review on Current Practices [1]	Conventional Approach	Managing the IT change by looking at the challenges in three dimensions: business, processes, and people.
		Outsourcing	Third party.
		Model of Change Management	Anticipated changes, emergent changes, opportunity-based changes.
		Three-E Strategy	Evident, easy-to-use, essential
		The Gartner Hype Cycle's Priority Matrix	This tool helps organizations in prioritizing emerging technologies
		Change, Adapting, Learning Model (CALM)	CALM focuses on measuring and addressing organizational readiness to accept and respond to technological changes.
		Cultural Theory	The role of culture in the management of technological change.
2	How IT organizations handle rapid IT change: Five coping mechanisms [3]	Education and Training	Staying informed about new IT as it becomes available and an instructor providing guidance in the use of new IT.
		Vendor Support	Using IT suppliers for problem detection and resolution, functional enhancement, and other assistance.
		Endurance	Ignoring or working around problems, and learning new IT via self-instruction.
		Internal Procedures	Developing processes to aid in the evaluation, acquisition and implementation of new IT.
		Consultant Support	Engaging external IS professionals to help plan, implement, problem solve, or provide ongoing support.
3	Coping with rapid changes in IT [17]	The most used coping mechanism o Read to keep informed of available new IT o Inform IS professionals of the benefits of new IT	Managers should read each single new IT and they should be informed of the benefits for everyone.
		The two least used coping mechanisms o Document the differences between new and previous IT o Ignore problems	Documenting the difference between new and previous IT will not add anything in attempting to solve a problem. Also, ignoring problems is not a way to solve them.
4	Coping with rapid change in information technology [2]	Education & Training	Staying informed of new IT as it becomes available and providing an instructor for training and guidance in the use of new IT
		Consult Support	Engaging external IS professionals to help plan for, implement, problem solve, and provide ongoing support for new IT.
		Vendor Support	Relying on IT suppliers for problem detection and resolution, becoming accustomed to, interfaces with, and functional enhancement of new IT
		New Procedures	Developing processes to aid in the evaluation, acquisition, and implementation of new IT
		Endurance	Ignoring or working around problems, and learning new IT without formal education
5	Changing information technology and information technology management [4]	Education & Training	This includes formal and informal, in-house and off-site, and vendor, third party and internally provided instruction.
		Inaction	Ignoring problems
		Internal support	The organization solves the problem internally.
		Vendor support	Organizations attempt to avoid or minimize problems with changing IT by obtaining support from the vendor of the IT.
		New procedures	Some subjects describe their organization's new procedures to ameliorate the problems caused by changing IT. Examples include procedures for selecting, testing, and using IT, as well as controlling change.
		Persuasion	Managers participate in efforts to cope with the problems of changing IT by persuading vendors to resolve problems and by convincing IT staff and users to accept new IT
		Endurance	As above
		Additional technology	Organizations acquire or upgrade one technology to solve the problems caused by a different, new one.
		Staffing	Organizations respond to changing IT with new staffing decisions. They change hiring practices and staffing structures.
		Consultants and other users	The organization's reliance on external consultants and users from other firms in enabling them to deal with changing IT.
6	Designing complex organizations [15]	External resources as consultants, Vendors, or users	The organization relies on external consultants and users from other firms in enabling them to deal with changing IT
		Educational courses	Training the staff and IT managers.

III. RESEARCH METHODOLOGY

To achieve the research objectives a qualitative methodology has been used as it is a more appropriate investigation tool for getting closer to reality and obtaining richer information from participants. An interview is a

powerful tool for data collection in qualitative research. Therefore, the main research method used is interviews with IT professionals; in addition data was collected from the printed/online documents belonging to the institutions, and literature reviews of published work.

The interviewees were chosen from different education institutions across the country (SQU, Sohar, Nizwa, and Dhufar universities). Three different ways of interviewing IT professionals was used: face-to-face interviews, as well as online interviews (using video conferencing tools) and phone interviews. At the beginning of each interview researchers explained the purpose of the interview orally to the subjects to help them to focus on the topic. Having guaranteed the individual anonymity, the researchers asked for permission to record the face-to-face interview. If permission was not granted they took extensive notes while the interviewee answered the questions.

There were a set of open-ended questions which interviewees needed to answer, and any clarification or additions were also noted. At the end of the interview, the interviewees were asked to provide any printed/online material they had relating to the topic.

IV. RESEARCH FINDINGS AND DISCUSSION

After interviewing 32 IT professionals (8 from each of the four institutes) as well as reviewing the institutions' available documentation, the data collected was analysed using thematic analysis in its simplest form, i.e. categorizing the challenges and the coping mechanisms.

The first question in this research was: 'What are the problems/challenges IT managers face in modern organizations and especially in higher education institutes?'

The main finding is that the managers of IT departments face many challenges and obstacles in order to comply with best practice and deliver the required services. The following section highlights the different categories of problems/obstacles that were detected while attempting to get an answer to the above research question. It was found that the legacy problems are significant. These encompass old hardware, software, regulations and human factors (i.e. the IT staff). With the growing expectations of the current generation of customers it becomes necessary to always stay up-to-date. Based on the findings of the interviews, documentations and literature reviews, the problems are classified as follows:

A. Human Factors

The obvious problem in this regard is that employees' knowledge becomes obsolete and some of them become less interested in keeping it up-to-date. Another challenge facing a new staff member is that once they are immersed in the old environment they become careless and unwilling to be innovative due to the bad influence of the old staff. Moreover, higher education institutes face a challenge in recruiting highly skilled experienced staff due to competition from other institutes in terms of salary and other incentives.

Continuous training, evaluation and staff retention are significant elements in focusing on helping the organizations do better in coping with technological change, but not taking into consideration the human factor is the main reason for organizations' failure in this. The training itself, if it is not delivering its desirable benefit to the trainees, will cause another problem, which is the waste of money and time as

most IT training courses are very expensive. So, well-planned training is strongly recommended to maximize the return on investment (i.e. usefulness). Unquestionably, training can provide a good insight into a new IT. However, according to Benamati et al. (1997) [4], it was reported that more complicated, unanticipated matters such as problem detection and debugging caused IT professionals great frustration. Both IT professionals and users could feel the effects of the lack of training.

B. Technological Factors

Converting from an old technology to a new one such as web-based application requires new skills and calibres. Recruiting highly skilled people takes us back to the previous point, which is a challenge in itself. In another words, lack of skilled technical support (IT staff) is a major problem.

Software and Hardware:

What is more, as old electronic systems (software applications) become obsolete they require updating or replacing, in the course of which problems regarding rules and regulations may be encountered. Also, the lifespan of hardware and software is becoming ever shorter as new technologies are introduced every day.

The upgrading to newer systems can be very expensive on the one hand, and on the other the process of upgrading can be very cumbersome for the IT staff to carry out, and disturbing for the organization's daily operations.

The replacement of an old system with a new one is a challenging task for an IT department. Quick replacement is not easy, as sometimes both systems (old and new) need to run in parallel. Bates (2003) agrees with this, stating: "There is always a period where old and new systems should run in parallel. It may be for several years after a project has started" [9]. Two systems working in parallel will lead to users' or faculty resistance due to the extra work required.

Digital Divide Factor:

Digital divide is another challenge that is associated with new technology. It signifies a lack of appreciation of the benefits of using the new technology. One participant said that changing people's mentality is a challenge: "The programmer can't change people's mentality"; and "Mentality is not easy to train". The possible explanation for this reaction is that some people stick to routine tasks and activities and when a new IT solution is made available to them they refuse to put the time and effort into learning how to use it. He added, "Problems regarding new technology exist but now there are better tools and a better approach, which lead to less time spent, thus lowering the cost, and requiring less effort all round, but only if people realise the importance of learning to use the new technologies as they come along".

There is a huge difference between the older generation of IT professionals and the current ones. This gap is, however, starting to disappear because older people are retiring and the younger generation coming along behind them are much more familiar with technology in their daily lives and are eager to try everything new in technology.

C. Rules and Regulations

Why is changing an old system for a new one challenging to the IT department? The replacement of an old system with a new one requires long procedures. Changing the internal procedures for the newly reengineered process is one of the obstacles that many IT managers complained about. To make small changes in the internal procedures requires great effort and may drag on for a long time.

These procedures need to follow international standards (such as ITIL and ISO). The Information Technology Infrastructure Library (ITIL) is defined as the most widely adopted approach for information technology service management in the world. ITIL provides straightforward instructions for the recognition, planning, implementation and support of IT services in business" [18]. The International Organization for standardization (ISO) is an international standard composed of representatives from various national standards organizations.

D. Organizational Structure: IT Department Authority

Another significant challenge that the higher education institutes are facing is in the structure of the organization itself. This problem occurs when the IT centre does not know to whom they should report to and sometimes they are connected to non-executives. To overcome this problem the IT department/center should be given total authority in the decision-making. In other words, if the IT department/centre is not located in the right position in the hierarchical structure of the organization it will face many hurdles.

Decentralization of the IT services is another challenge that can be very expensive. There should be clear policies that every department should follow in order to gain/access the required IT services. If the IT department does have the full authority regarding making the overall organizational decisions, there should be a well-known authority that solves the inconsistency between the departments.

As a result of the inability to meet expectations due to the challenges stated above, another problem is generated, which is the lack of trust in the IT department. Hence, IT departments face many difficulties, which all play a large role in diminishing the trust in them.

All these challenges lead to the decentralization of IT services; a process that does not lead to the full utilization of the "Big data" that was created by using the ever-so-many computer applications that are spread across each education institute. Furthermore, decentralization harms the trends towards data mining, data warehousing and business intelligence of the organization's stored data, which is supposed to aid decision making by enabling informed decisions to be made.

E. Lack of Support

Funding information technology in higher education is a major concern not only for institutional chief information officers (CIOs) but also for intuitional chief business officers (CBOs) and other executives. In today's challenging environment, reducing cost and adequate funding are major

concerns [19]. One participant, agreeing with what Goldstein and Caruso (2004) stated, said that the cost is a major concern, but new IT services and technology can cover the cost indirectly by providing a better quality service, better maintenance, better performance and better productivity. This finding supports the ideas of Kipsoi et al. (2012) [13], who stated that the lack of administrative support, institutional support through leadership, and planning in implementing change are some of the challenges IT managers are facing.

The second research question was: 'Do the new organizations face the same problems as the older ones? If not, what is the difference in nature between the problems that each face, and why do these problems occur?'. When the participants were asked this question, their answers were almost all the same, which was ("No, they don't"). The nature of the problems facing the new organizations differs from those facing the old ones. This is because in the new organizations there are no legacy problems. A possible explanation for this might be that new organizations begin with the latest technology, and so start by deploying the best IT applications, IT services and solutions. Moreover when a new organization is set up there is no data migration, and international standards are being followed. However, if the new organization is using ready-made packages then the maintenance is more expensive (than in-house-built systems) but it is more professional.

The third research question was: 'How can such challenges/obstacles be better mitigated?'. Regarding this question the participants had different viewpoints. Most of them agreed that a better way to solve these problems is to implement new strategy and mechanisms. The first strategy is that top management should appreciate the importance of IT for organizations success. This appreciation is essential in order to do whatever is needed to boost performance and productivity. Secondly, the top management needs to have the courage to support the IT manager (CIO) with regard to spending, re-engineering the current procedures and recruiting skilful IT staff. Thirdly, specialization in a narrow area is important because it provides a better understanding of the assigned tasks, which leads to better results. Fourthly, the IT department should be the core of any organization; it must work side by side with the organization and have the authority to make decisions. Moreover, to solve some problems radical solutions are sometimes required, not just partial or temporary ones.

On the other hand, one participant emphasized that the leadership should be able to solve IT problems and challenges; he said, "The organization needs a leader who can read the current situation and plan for where the organization needs to be in 10 years' time".

Findings from the literature as well as from the interviews show that there are many challenges/obstacles facing IT managers in the higher education institutes. The researchers grouped these challenges in categories, as shown in Fig 1. The top-level categories are: human factors; technology factors; lack of support; organization structure; training demand; and rules and regulations.

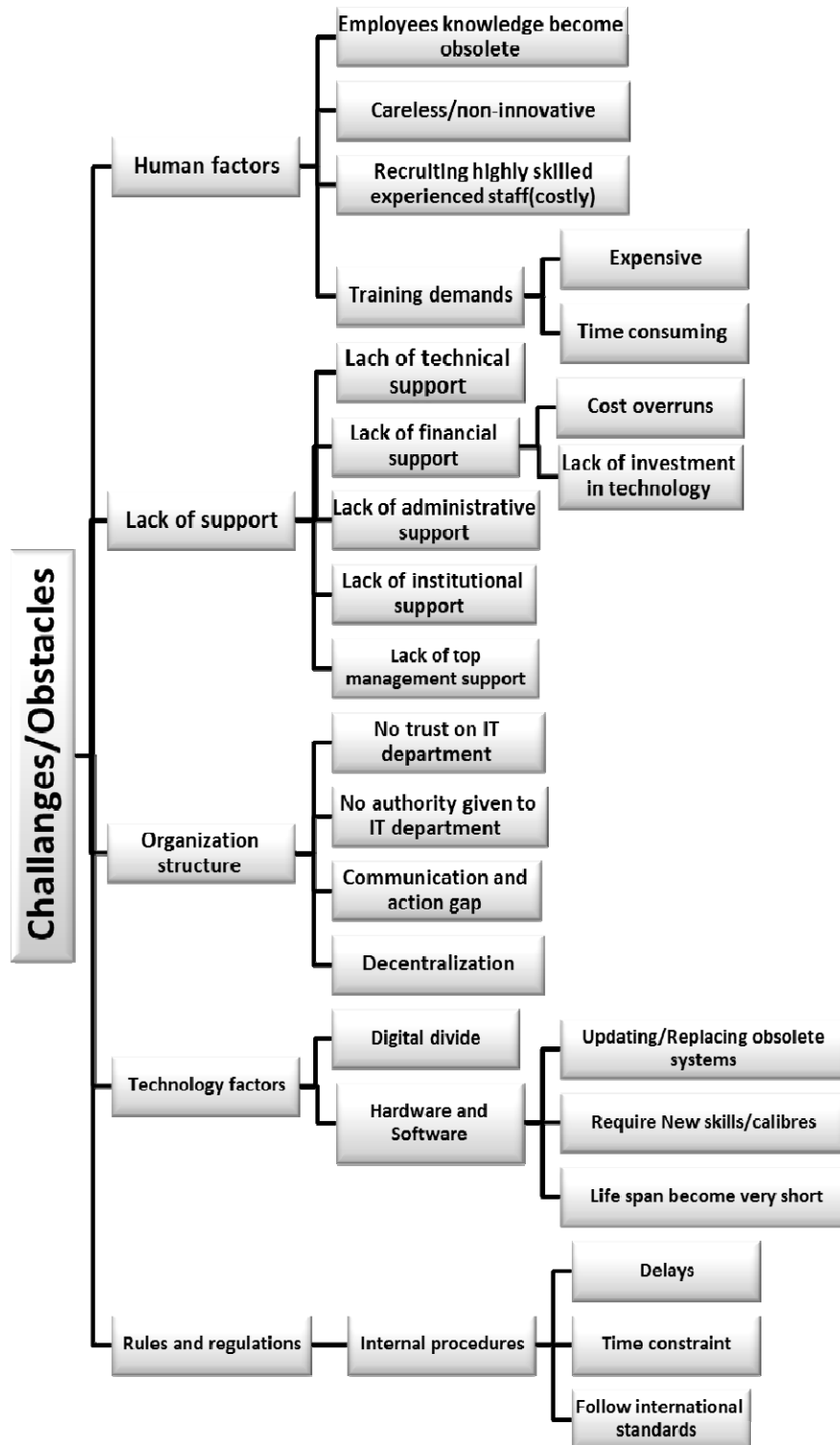


Fig. 1 Summary of the challenges/obstacles

To overcome these challenges many different researchers proposed different coping mechanisms. Fig. 2 represents the coping mechanisms as revealed from both the literature (previous studies) and interviews. For most of the interviewees the most influential mechanisms are those relating to

organization structure and the human resource factor. It was found that the efficient use of human resources is the main mechanism used in order to reduce the challenge created by rapid changes in IT. This was explained by one of the participants, who said that there are many tools easily

available, but these tools need to be employed by someone who understands the problems and can work out what should be done, choose the suitable tool and start doing it. The second significant mechanism is related to the structure of the

organization and where the IT department stands within it. If the organization does not consider the IT department as the core department/authority, it will struggle in coping with rapid information technology change.

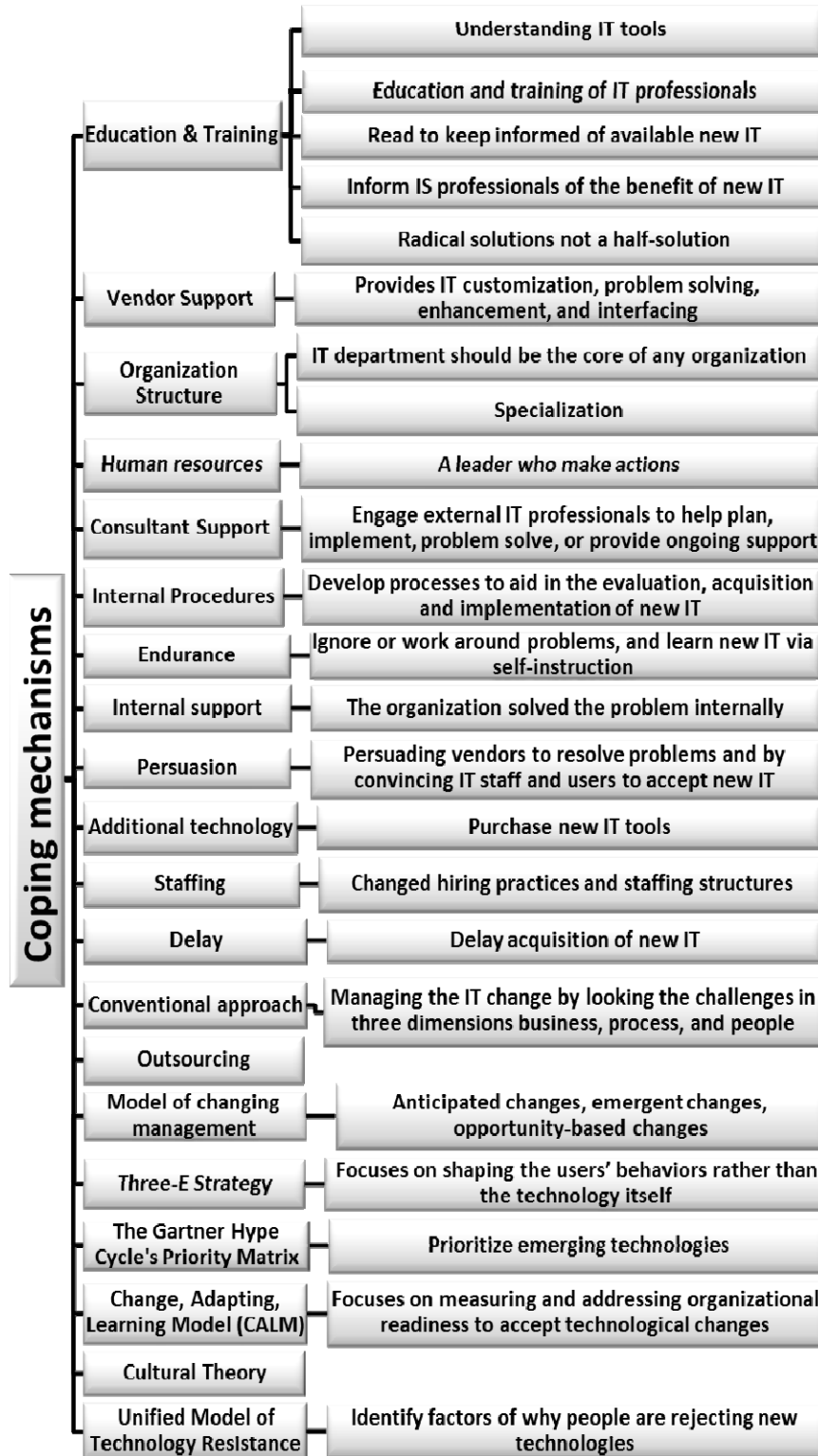


Fig. 2 Summary of the coping mechanisms

V. CONCLUSION

To conclude, the purpose of the current study was to identify the significant challenges that might face IT managers (CIOs) in higher education institutions and to propose possible solutions to cope with such rapid changes in information technology. One of the most significant challenges that IT managers are facing is the legacy problem, which is related to updating IT staff skills and capabilities, problems in upgrading the different hardware and software, and problems in bridging the gap between older and younger customers in terms of IT needs and expectations. Another significant challenge is in the structure of the organization. The IT department should be placed in a position in which it has the power and the authority to make decisions.

This research has highlighted many possible solutions using different tools and mechanisms. Not the least of these is that IT managers should have a good understanding of the current IT tools and technologies and make use of the newly available tools. For example it may be better to use cloud computing to provide IT services rather than owning the hardware and software with all the consequences and expense if one needs to expand the service provided.

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