

Management of IT Services in the Field of Pre-Hospital Emergency Management with the Combined Approach of COBIT Maturity Model and ITIL Framework: A Conceptual Model

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Abstract

The purpose of emergency management planning is to enable the management to make quality decisions under the pressure of time to avoid or minimize the damage. Planning is a complex issue, which involves key actions and critical decisions. It improves the response to the effects of a disaster by organizing timely delivery, effective rescue, relief and timely and reliable assistance; also, it ensures that the right people are functioning at the right time. Effective plans are also intended to provide and possibly include the resources and proprietary funds that are provided through powerful rules. Written and well documented programs increase the likelihood of successful outcomes.

This research aims to develop an information technology (IT) maturity model for pre-hospital emergency management that merges the most known IT frameworks' practices. Our proposal intends to help the organizations overcome the current limitations of multiframework implementation by informing the organizations about the frameworks' overlap before their implementation. ITIL is the most popular "best practices" framework for managing Information Technology (IT) services. However, not only implementation of ITIL is very difficult, but also there are no recommendations and guidelines for it. As a result, ITIL implementations are usually long, expensive and risky. In this paper, we proposed a maturity model to assess an ITIL & COBIT implementation and provided a roadmap for improvement based priorities, dependencies, and guidelines. We finally concluded that considering ITIL & COBIT implementation in pre-hospital emergency management could be very useful.

Keywords: IT Services, Pre-Hospital Emergency Management, COBIT, ITIL

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Introduction

The role of information in today's world is so dramatic that the current age is called the age of the explosion of information. On the other hand, the use of information technology in organizations is also rapidly expanding, and organizations need to use information technology to achieve their goals. Thus, information flows everywhere and its impact is comprehensive. IT in the era of environmental accelerations and changes is critical to the survival of organizations. Information technology enables the managers to quickly and easily process information to control and coordinate more complex structures. Additionally, information technology enables the organization and management to function with coherence and rapid feedback (1).

Meanwhile, the use of IT increases the ability of individuals or organizations to communicate more easily, more accurately and less costly; moreover, human error in the organization's information processing network decreases. Nowadays, organizations can transfer commands and messages without a traditional management structure across the organization through the use of computers and automatically automating part of the organization. In this way, employees have access to a lot of information and they can come to an early conclusion in their work. Information technology has affected various aspects of the organization. Information technology enables the managers to communicate with each other and with employees and get information about the results of each other's work and their employees.

The computer system creates a new communication channel that managers can use and become a group. This technology helps the managers eliminate barriers and creates a sort of group feeling between authorities and employees that results in the identity of the organization (1).

Information is one of the most important tools of management capability. The acquisition of information, in particular information that appears to play a pivotal or strategic role in the organization, can be used to build a power base and also to promote and empower a person in the organization. On the other hand, when administrators equip themselves with more information, those people feel empowered and are more likely to work with productivity, success, and in line with management requirements. By reinforcing others in gaining results, the director actually strengthens his power base. With more information, people tend to experience self-control, personal control, and more confidence. Customer satisfaction is one of the internal measures of organizations that shows their orientation towards meeting the customers' demands and improving the quality of the products and services (2).

Also, using the ITIL and COBIT framework, the convergence between business and IT makes these frameworks a bridge between technical managers and senior executives. Using ITIL, an organization can create the added value that results in benefits of competition, and COBIT can be used to determine the appropriate decision for how the organization operates (3). In a small number of articles, a combination of the ITIL framework and COBIT maturity model has been implemented, i.e. the integration of IT governance with the management of services in a specific way. Moreover, the use of technology services management frameworks in the field of health services is very limited; it indicates that the importance of this topic in the field of health has been neglected and through discussions with the professors and experts in the field of emergency management can help to find a suitable solution to solve the problem of emergency management at strategic and tactical levels. Therefore, the aim of this study is to design an Optimal Framework for the Implementation of Information Technology Management Services in the field of pre-hospital emergency management with a combined approach to the COBIT maturity model and the ITIL framework”.

Literature

Enterprise Information Governance

The concept of IT governance has existed for

less than two decades. In the early 1990s, key areas of IT governance were recognizable in scientific literature. Initially, alternatives to the organization of information technology and the impact of those forms on business results were studied (4). The second field examines the nature and impact of the route between the corporate IT service (“business”) and the IT functions. Third, inspired by Porter’s research on strategy and competitive advantage, the relationship among organizational strategy, investment in information technology, and organizational performance has been formed. This field led the researchers to react to Bernie, which is indicative of a paradox between the high levels of investment in information technology and the lack of evidence of return on investment. It was only in the late 1990s that the articles referred to the sovereignty of information technology in the title or abstract although these articles focused on the most effective form of information technology organization. In the field of internship, ISACA created the IT Governance Institute in 1998 to promote the concept of IT governance. In short, various ISACA and ITGI publications clearly integrated the concepts of IT governance in COBIT 3 (5), summarizing the IT governance discipline (4).

Framework of COBIT

The goal of many organizations is to improve the growth and development of competitive advantage, and at the same time using information technology to increase the efficiency, flexibility and innovation. The prerequisite for such strategies is to understand a “qualitative” concept of information technology and to define the control objectives in order to guarantee this qualitative concept. The control objectives for information and related technologies, referred to as COBIT, are the framework developed by the ISACA Institute For guidance and management of information technology in organizations. This framework actually helps the senior executives to fill the gap in control requirements, technical issues, and business risks. In addition, it supports the IT management by combining business goals with technology goals and processes (6). Within the framework of COBIT, the ITGI IT Management Institute has close ties with ISAA, which is being produced and published. While Isaac is more involved with the direction of the IT audit issue, it focuses on R & D. Isaac also provides ICISA (Confirmed Information System Certification Audit) with experts (7). The questions raised by the top management of the organization in the area of information technology that this framework aims to

respond to is (2):

- Does the IT organization do any good work?
- Are things done right?
- Do things go right?
- Does the organization benefit from this?

Accordingly, the COBIT Framework has been working to integrate the standards and industry practices into the following areas (8)

- Strategic IT together with business goals.
- Creation of value for new products and services.
- Risk management.
- Resource management.
- Efficiency management.

Specifically, this framework uses standards such as ISO / IEC 27002 and ISO / IEC27001 and other frameworks such as ITIL and PMBOK (9). It provides a framework for executive management, aiming at the management of information technology in the organization (Figure 1) (10):

- Using more effective IT tools to support business goals.
- Creating greater transparency and better prediction of the overall cost of IT life cycle costs.
- Getting timely information and more reliable information technology.
- Providing more quality IT services and more successful projects.
- Managing more effective IT risks.

ITIL Standardized Management Processes

ITIL is a set of documented processes designed to define how IT companies operate. The systematic structure of ITIL and the step-by-step implementation of the processes defined therein allow the administrators to properly manage the performance of all parts and levels of the organization. The

documentation provided in ITIL and those provided by the key personnel activities are actually a way to prevent the loss of knowledge and awareness of the organization.

The ITIL standard supports the management of IT services in the areas of service provision and service support. In the context of the Operations Center, the support system is discussed and consists of the following parts (11):

1. Configuration Management
2. Support of services
3. Management of events
4. Management of problems
5. Change management

Configuration Management

According to ITIL, the goal of the configuration management is to provide a logical model of the IT infrastructure by detecting, controlling, maintaining and verifying the versions of all the existing components. Configuration management is the key to effective management of all levels of the organization. In this management, in addition to the physical information related to assets, documentation and service contracts, catalogs and letters of commitment are also included.

All of this information is stored in a database called CMDB, which is actually a repository of all IT assets and services and their communications. This database provides a single source of information that can be used as a shared resource by other service management processes. The quality of information available in the CMDB is very influential on the ITIL strategy. Managers can use configurable information to improve the performance of different departments by anticipating necessary changes based on business needs. The configuration management process,

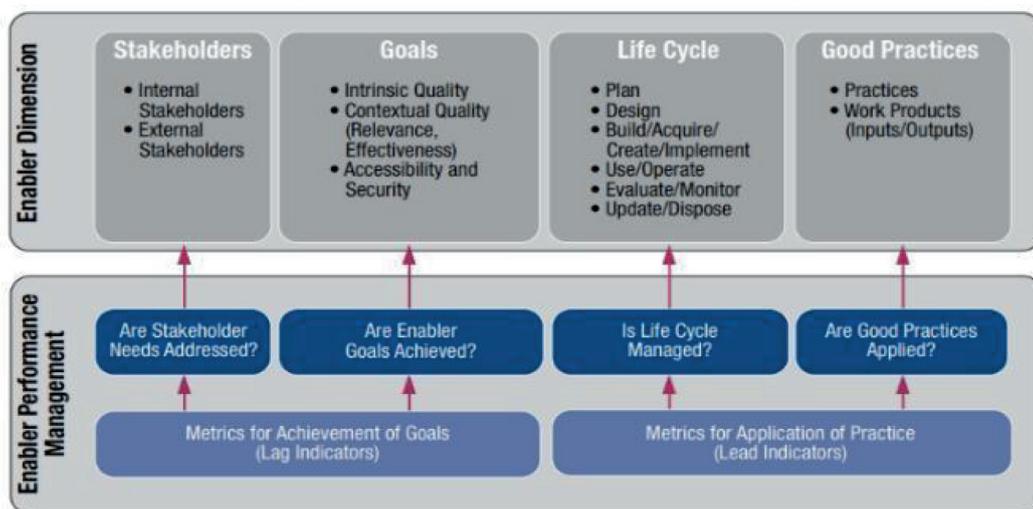


Figure 1: COBIT model

information about each (CI) and its relationship with other CIs and services are included (12). Configuration management should focus on the following objectives:

1. Use the assets optimally
2. Increase the asset life
3. Understand the relationship and dependence between IT assets
4. Improve and increase asset availability time

Event Management

According to the ITIL standard, the goal of managing the event is to return the service to a normal state in the least time and reduce its negative impact on business operations. The main processes for managing the incident are listed below (12):

1. Identify and record the incident - Incident Detection and Recording
2. Classify and support primarily - Classification and Initial Support
3. Research and diagnose - Investigation and Diagnosis
4. Troubleshoot and recover - Resolution and Recovery
5. Close the incident - Incident Closure

Change Management

Unauthorized changes to the assets or information of the organization can lead to poor service delivery. Any changes in the organization should be fully controlled and we should ensure that the risk of changes to the system is managed to an acceptable level and not compromised on the services provided. In the management section of the problem, in order to resolve the problem, it is necessary to apply some changes to the infrastructure. Therefore, at this stage, a category called the request for change is made. The request for change can be replaced by a monitor, or at higher levels of displacement or deinstallation and installation of the staff. Change management is a method for managing, controlling changes, identifying changes, and designing and scheduling changes (13).

According to ITIL, change management should focus on the following objectives:

1. Implement and apply appropriate changes to assets and processes
2. Reduced service interruptions

Therefore, if any changes are made to the system, proper management should be made on those changes, and the impact of that change on the quality of the services provided should to be fully controlled.

Services Management

According to the ITIL standard, the goal of service management is to improve the qualitative and quantitative services through controlling, reporting, and visiting IT services. Given that IT topics are complex and only understandable by technical experts, it should be referred to as a part that involves centralized and connected technical processes to resolve the events, problems and changes in the organization, and appropriate management is applied (13).

Deciding on the ITIL Preparation Method

After deciding on how to implement a new technology in an organization, it should decide on the most appropriate type of technology in terms of proportionality with the goals and type of organization's performance. There are various methods for choosing a new type of system. Therefore, the organization should choose the best system based on cost-benefitness and considering its level of maturity, strategic level, knowledge and specialty of the staff, facilities and the ability to plan the best system for its implementation in the organization (14). Various ways to select a system are (13):

Complete the system of a particular company

In this way, the system is completely purchased from a company, without implementing changes and adapting to the nature and culture of the organization. This is the fastest and least costly way to implement the system. However, due to system mismatch with the culture and processes of the organization, it creates many problems for the organization. Since in this way the processes of the organization should be changed and adapted to those of the new system, employees should be trained in many ways. Therefore, this method might face with the staff resistance.

Purchase a new system and comply with organizational processes

Since the modification and adaptation required by organizational processes has increased the time and cost of implementation, but due to the adaptation of processes with the system, the system's acceptance in the organization has increased; however, the cost of training the staff will be reduced (2).

An anthology of the best practices from different companies

This technique is ideal in theory, but faces a lot of problems in practice. Because the integration of different modules requires the use of specialist consultants and expenditure, in case the modules do not integrate well together, the organization will face a lot of problems (14).

Selection of only a few modules from a specific system

In this way, strategic units of the organization are defined and only certain parts of the new system for implementation in these units are selected and implemented. Implementation costs and time in this method are lower than the other methods and the risk of system application is reduced.

Full development of the system within the organization

In this case, the organization should have a high maturity level, so that it can use the internal experts to design and develop a new system. As a result, such a system is most consistent with the processes of the organization and is easily accepted by the employees. This is the most difficult, costly, and longest method of system implementation that is rarely used (2).

Institutional development of the system and utilization of successful modules of other companies

This method is a combination of other methods. In this case, the sector or system is formed within the organization, and the other part is completed using the modules used by other companies. In this method, in addition to internal development, the modules should be selected and integrated (14).

Discussion of the Status of the Organization

After reviewing and studying a variety of methods for the emergence of a new technology in the organization and familiarity with a variety of methods for preparing it in accordance with

the theoretical framework, we can now use the organizational maturity level that was found in an in-house research project called maturity analysis. A process has been calculated to analyze and propose a solution to how ITIL is implemented and how it is prepared (Figure 2) (2).

Emergency Management Planning for Health Organizations in a Developing Country

Accidents are serious disruptions that undermine the capacity of local, regional and national systems (16, 17) and require specific resource mobilization and organization above the usual mode (18). Fortunately, events rarely happen. However, careful planning and training is needed to promote individual health organizations for such events. Some authors (19-21) have defined the goals of planning emergency management as the following: The purpose of emergency management planning is to enable the management to manage quality decisions under the pressure of time to avoid or minimize.

Planning is a complex issue, which involves key actions and critical decisions (22). It improves the response to the effects of a disaster by organizing timely delivery, effective rescue, relief and timely and reliable assistance, and ensures that the right people are functioning at the right time (7, 23-26). Effective plans are also intended to provide resources and possibly include resources and proprietary funds that are provided through powerful rules (27). Written and well documented programs increase the likelihood of successful outcomes (28).



Figure 2: ITIL Processes and Functions (15)

In general, there are three types of planning: comprehensive disaster management planning, business continuity planning, and contingency planning. A comprehensive Emergency Management Plan deals with these issues as how an organization can help its customers cope with the tremendous demands that the disaster creates. It specifies the guidelines and service standards for all responsible departments (Figure 3) (29).

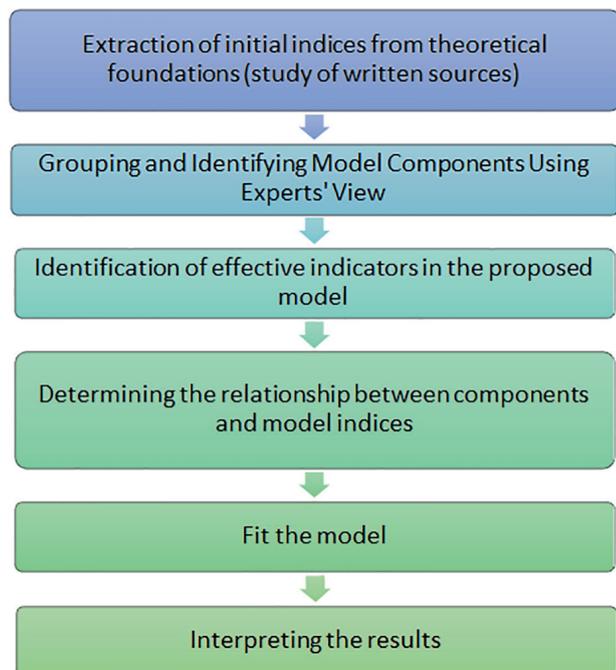


Figure 3: Research Steps & Road Map In pre-hospital emergency

Rid (1994) has conducted a research entitled “Development and Accreditation of a Decision Support System for Locating Emergency Vehicles in Louisville, Kentucky.” The reduction in the time taken to respond to an emergency is an objective of the Medical Emergency Services (EMS). The size of the ambulance fleet and the position of ambulance in the service area are two factors that EMS planners can control; these two factors directly affect the response time of the system and help to achieve this goal. In this paper, an Expected Maximum Coverage Model with Timing Changes (TIMEXCLP) is developed and integrated into a decision support system (DSS) to help the EMS planners to allocate vehicles in their service area. When the TIMEXCLP was used for the EMS system in Louisville, Kentucky, response time was reduced by 36% (30).

Jondriou et al. (2001) have conducted a research entitled “Exploring a Dynamic Model and Prohibited Search Algorithm for Real-Time Ambulance Transfers.” This research considers the transfer of an ambulance fleet. This problem can be seen in

the real-time management of emergency medical services. The dynamic model is proposed and the dynamic management system for ambulance is described. This system includes a discovery of a banned search algorithm to predict displacement scenarios. Simulation based on actual data confirms the proposed approach (31).

Matthew et al. (2010) have conducted a study entitled “Approximate dynamic planning for ambulance transfer (deployment)”. We provided an approximate dynamic planning approach for deciding on ambulance transfers in an emergency service system. Our initial decision is about where we need to restart empty ambulances to answer the maximum number of calls that are on the threshold of delay. We begin by formulating this problem as a dynamic program. To deal with the unobtrusive and unexplainable dimensions of the dynamic program, we approximated the value function that is parameterized by a few parameters. We adjusted the parameters by simulating the system cost paths. Computational experiments indicated the efficiency of the approach in emergency services systems in two urban areas. We actually report significant improvements in efficiency relative to baseline static policies (32).

Wade (2012) conducted a research entitled “Does the timely response of an emergency medical system have health and health implications?” The introduction of technology to reduce the response time of emergency medical services has been one of the most important innovations in critical care over the past decades. These basic investments are typically justified by a hypothesized link between the shorter response time and the implications of health improvement. However, future medical research generally does not show the relationship between response time and mortality. In this study, we explained the difference between conventional wisdom and mortality; the existing medical research has failed to explain it due to the innate nature of the severity of the incident and the reaction time. By analyzing accurate contact information from the U.S. Emergency Services Office, we measured the impact of reaction time on mortality and hospital delivery using an accident distance from the nearest EMS organization’s headquarters as a tool for response time. We found that reaction time significantly affected the mortality and hospitalization probability; the method of delivery in the hospital did not have a significant effect (33).

Lim and Bruner (2011) conducted a study entitled “The Impact of Ambulance Policies on

the Effectiveness of Emergency Medical Services.” In ambulance positioning models, fleet size and ambulance position are two critical factors that emergency service managers (EMS) can control to ensure effective delivery of the system. Transportation and ambulance delivery policies that are studied in dynamic ambulance switching models will also be helpful in improving the EMS response time. In this paper, we examined dynamic ambulance displacement models from the perspective of deployment policies. The relationship between ambulance screening policies and real life policies has been identified. Our ambulance model is based on the problem of maximum coverage (MCLP). This method typically uses switching policies and the proposed method of operating an ambulance to improve the

fast response during the call. The simulation results showed that the proposed method can reduce the response time to instant recalls, especially in the period when the ambulance is low. We also compared EMS performance with and without dispatch with redirection ability (34).

Silissliga (2017) has conducted a research entitled “Service life cycle of ITIL services for small and medium-sized enterprises of Polish ICT industries”. The purpose of the research is to provide the implementation of the life cycle of ITIL services in SMEs (small and medium-sized enterprises) ICT sector in Poland. Modern IT companies are focusing on providing customer service. The ITSM framework, like ITIL, activates this change in IT companies. This article provides unique knowledge on the adoption

Table 1: Dimensions and sub-components identified by the COBIT framework

Dimension	Sub-components	Ref
Management	Management of participation, investment management, change management, stakeholder management, facilities management, performance management, human resources management, data management, configuration management, quality management, communication management, operations management, service management, Risk management, stakeholder relations, existence of project management skills, management of the physical environment of information technology, supply and maintenance management, culture management, communication management, organizational knowledge management, response speed,	(2, 37-44)
Organozation	Organizational structure, internal improvement, organizational commitment, customer-oriented culture, technological culture, system thinking, rules and regulations, proper response to opportunities,	(2, 37-44)
Process	The relationship between processes, proper implementation of processes, the development and maintenance of the methods, identification of the main processes, identification of operational processes, definition of IT processes and communication, replacement of old systems with new ones,	(2, 37-44)
Vision	Technological advances, technological orientation, strategic alignment with technology, strategic strategic planning, technological vision, strategic plan definition	(2, 37-44)
Organozation Goals	Business goals, adaptation to changes, software compatibility with organizational goals, transfer of goals and management orientation, reliability, effectiveness, efficiency, follow-up and access, need assessment of technology courses,	(2, 37-44)
Staff	Employee training, innovation and creativity, user training, coordination of specialists and other employees, consulting, organizational resource planning, culture of knowledge sharing and collaboration, user-oriented culture, trust and confidence in information technology, continuing IT training, staffing and managers’ compliance speed with changes, continuation of the use of information technology, availability of information skills, creation of equal opportunities for employees, use of the structure of knowledge-based teams, knowledge sharing, motivation,	(2, 37-44)
Control	Internal control, evaluation, compilation of indices and standards, ensuring compliance with external conditions, monitoring and evaluating performance, providing governance of ICT, continuous control,	(2, 37-44)
Organize	Specific work policies, work practices, planning, activity categorization, identification of automated solutions,	(2, 37-44)
Support	Financial reports, prevention of unwanted events, reduction of risks, sufficient resources, allocation of costs, prevention of unwanted events, existence of decision support system, support for new ideas, possible applications, appropriate software packages, existence of senior management support system, existence of System Administrator Support.	(2, 37-44)
Information architecture	Providing information at the right time, appropriate information, information security, existence of IT and communications unit, software and hardware, continuous improvement, information unbundling, architectural development, announcement and observability of results and benefits, information, flexibility, existence of the portal, existence Blog, secure and easy access to information, updating and completing the software portfolio, the existence of transaction processing systems, acquisition and maintenance of technology infrastructure.	(2, 37-44)

of ITIL service cycle processes in SMEs with special emphasis on deploying different sectors of ICT. This paper presents the result of its study on 345 SMEs from the ICT sector in Poland (35).

Also, in a study conducted by Bhat et al. (2010) entitled “Creating and Influencing Information in a Dynamic Environment: The Role of IT Infrastructure Infrastructure as an Organizational Responsibility and Competitive Advantage”, understanding how information technology contributes to the company’s competitive advantages has historically been very much considered. While executives have made significant investments in information technology, inherited dormant systems impede their ability to accelerate responses to market opportunities. This study examined how the flexibility of the IT infrastructure increased the production and dissemination of information, which increased their ability to respond to changing environments. The information and the effects of information penetration were based on a company-based resource perspective. Experimentally, the model was tested using the data collected from top managers of 105 manufacturing and service companies. The researcher in this study found that the flexibility of the IT infrastructure was positively related to the production and dissemination of information. In addition, information production was significantly associated with organizational accountability. Finally, organizational responsiveness was positively associated with competitive advantages. These results highlight the importance of developing a flexible IT infrastructure that can quickly adapt the data and re-adjust to meet the needs of information processing in dynamic environments (36) (Tables 1 and 2)

Conclusion

Problems and disadvantages of using a traditional and non-process management system in the field of pre-hospital emergency management

- ✓ Using unmatched monitoring system of different sectors and activities of the organization
- ✓ Spending a great deal of time for informing and fixing the problem
- ✓ Not setting up a precise and detailed system for recording events, problems
- ✓ Not creating a system for recording changes
- ✓ Establishing a standard procedure for tracking problems
- ✓ Making the information and knowledge available to the individual, not the organization

The issues raised are incapable of analyzing events and problems, resulting in inability to root problems. Lack of up-to date information for support experts will slow down the process of fixing the problem and turning the situation back to normal when an issue or event occurs. Not having the proper routine to track the problems does not solve the problems in a routine way and troubleshoot problems in a particular part. Lack of monitoring a part of the organization’s activities reduces the accuracy and stability of the system. At the highest level, business plans are driven by business goals, by defining how to achieve these goals by delivering the products and services, defining business processes, and allocating resources to advance the performance of the organization. By identifying the processes and how resources are allocated, it is possible to formulate an IT architecture that reflects the applications and information systems and their relationship with each

Table 2: Dimensions and sub-components identified by the ITIL framework

Dimension	Sub-components	Ref
Service delivery process	Identify critical processes, operational processes, assess current status, customer gap, streamline service delivery cycle, improve development processes, prioritize requests, customer service, business needs, process definition, relationship between processes, practice, process maturity IT, customer engagement, hand management, capacity management, service level management, IT service continuity, planning, service quality, agreed upon,	(3, 8, 12, 35, 42, 43, 45-53)
Support process	Change management, team building management, quality management, system management, appropriate budgeting, user communication management, resource management, strengthening support processes, employee motivation, IT governance maturity, definition of index, problem management, software infrastructure, training, commitment of the staff, assessment of current status, senior management commitment, process practices, project management, IT management department, creation of support bureau, continuous improvement of technology, user commitment, documentation, technology management capability, testing of results, coding instructions, culture building, configuration, Service desk, control and maintenance, service publishing management, event management, creation of data file, program strategic strategies, creating automated solutions, coordinating managers, coordinating objectives with technology, analyzing the resources, information accumulation, information classification, financial management, data collection, standardization, data ejection, prevention of borderless change, coordination in making and evaluating changes	(3, 8, 12, 35, 42, 43, 45-53)

other. This architecture should be arranged in such a way that the IT architecture is designed in accordance with strategies and in support of business processes, and this IT architecture will play the next role as a guide to defining IT projects. An important point in implementing an IT value measure is that it should be a permanent process in the organization. As the pilot in the cockpit of the aircraft is an array of displays of vital flight variables and aircraft status indicators, management must also create a panel of key indicators of performance and related measures, monitor the status of the systems within the organization, and adapt them to the environment.

In recent years, senior executives have noticed the importance of information technology in the success of organizations. They have learned that they need to be aware of how to manage IT in the organization. Using the ITIL and COBIT framework, the alignment between business and information technology makes these frameworks a bridge between technical managers and senior managers of the organization. By using ITIL, an organization can create added value that leads to competitive advantage, and COBIT can also identify a way to make the right decisions about the organization's operations. COBIT and ITIL are both valuable combinations that help the organization to manage business information technology. The ITIL provides guidelines for implementing service management processes, and COBIT helps the organizations align ITIL processes with business goals and needs. COBIT also provides an effective mechanism for managing and assessing the extent to which ITIL processes progress, as well as their continuous improvement within the organization. It can be said that the COBIT framework provides management and governance solutions under the control of IT processes, achieving organizational goals, monitoring the performance of each process, and benchmarking it. Considering the fact that a combination of ITIL framework and COBIT maturity model has been carried out in a small number of articles, that is, the integration of IT governance with the management of services has not been made in a specific way; furthermore, the use of IT service management frameworks in the area of health services is scanty, and this indicates that the importance of this topic in the field of health has remained neglected. Given the discussions with the professors and experts of the field of emergency management, this research can provide a suitable solution for solving the existing emergency management problems at strategic and tactical levels.

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