

Assessing Efficiency of ITIL Framework to Align Business And IT

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Abstract: Ensuring that IT and business have a more mature alignment relationship is recognized as being critical to an organization's success. To achieve alignment leveraging, Information Technology Infra-structure Library (ITIL) is considered fundamental as a comprehensive approach to planning and managing IT actions within the organization, based on its business requirements.

This survey reports on a study to assess the effect of successful ITIL Framework on the Business-IT alignment in an Iranian organization (municipality IT organization Of Tehran, Iran), using the Luftman's maturity model as the assessment tool.

Keywords: Business-IT Alignment (BITA); IT Governance; Information Technology Infrastructure Library (ITIL); Luftman's maturity model.

I. Introduction

The first decade of the 21st century has seen Information Technology (IT) make great strides, quickly evolve and grow so conspicuously, from a time when it was providing mere back office support, until now where it plays a strategic role in organizations. IT now supports several business strategies and also has the ability to introduce new strategies within organizations. Therefore, IT executives who are trying to shape business strategies within their own organizations see the pressing need to improve their own abilities to tap innovation [1]. Business-IT alignment (BITA) is one of the vital topics of IT management sciences and is often ranked first in the surveys of senior managers' top ten concerns [2]. Alignment is a complex concept involving several different approaches to understanding and achieving it [1] [3] [4] [5] [6] [7]. These approaches can be classified under three main categories:

- alignment via "governance" [8] .
- alignment via "architecture" [8].
- alignment via "relationship" [8] [6] [9].

Regardless of the reasons and rationalization of an ITIL Framework, these projects are expected to positively affect BITA improvements. Therefore, finding a solution to this problem, related to the type of method required to quantitatively measure the effect of the IT executive plans on achieving business strategies and goals, was the force that motivated this present study. The purpose of this study is to increase knowledge about the BITA factors influenced by an ITIL Framework. The two main questions addressed in this study are:

1. Does an ITIL Framework impact BITA improvement?
2. What is the scope of this effect?

This research focuses on the use of Luftman's alignment maturity assessment model [10] to examine the BITA maturity in An Iranian organization, whose the ITIL Framework have been completed after 2011. This research was conducted via a closed questionnaire, which had been designed according to the metrics of the Luftman's assessment model, to one organization that had completed the ITIL Framework. Ultimately, 33 questionnaires were received back and analyzed. The results of this study show a dramatic improvement in BITA on completion of an ITIL project.

This paper begins with a literature review on BITA, ITIL, BITA maturity models, as well as the Luftman's model as the main research tool. After establishing the theoretical foundation, an explanation of the research design is given, followed by data collection and analysis. Finally, a summary of the findings is presented , as a conclusion to the paper.

II. Literature Review

To develop a theoretical framework for testing the ITIL effects on BITA, multiple streams of related literature were examined. This consisted of studying previous and recent research literature to identify the nature of research that has been done thus far and what is yet to be studied, in the future.

2.1 Business-IT alignment

Business-IT alignment is the highly desired state in which an organization can effectively use IT to achieve its business objectives. This term particularly encompasses the efforts of the IT and business professionals to bridge the gap prevalent among the stakeholders of the organization, owing to differences in objectives, culture and incentives, including a reciprocal unawareness of one another. Aligning business with IT is a fast growing concept that was initially introduced in the 1970s; however, senior managers were not able to actually apply alignment in their organizations until the 1990s, when a systematic model was presented by Henderson and Venkatraman (1993). Studies show that organizations with IT-enabled growth are not only positively affected by economic impacts (e.g. increasing sales and decreasing expenditures) [11], they can also achieve a better strategic match, a more efficient IT architecture and more core competencies, as well as better decision-making and faster competitive reactions.

Several definitions have been proposed on BITA by scholars, of which the more important are listed below:

- Applying IT in an appropriate and timely manner, in accordance with existing business strategies, goals and needs [10].
- Matching business requirements with relevant IT services [7].
- The degree to which the IT applications, infrastructure and organization enable and support the business strategy and processes, including the processes to realize this [6].
- Aligning the information systems (IS) capabilities with the business goals [8].

Looking beyond immediate business needs, considering technology trends and competitive landscape to play a proactive role in shaping business strategy by applying IT [1]. As seen from the above, most of the definitions focus on a unilateral alignment; however, some definitions consider a bilateral relationship between business and IT. Due to this wide spectrum of definitions, several methods and frameworks have been developed to align business with IT. As shown in Table 1, the features characteristic of the different BITA models reveal that this concept can be realized at three levels [11]. After carefully reviewing the literature, this study clearly approves the classification given below. Alignment of IT/IS with business goals and strategies is the first level of BITA [9] [12]. The second level shows aligning IT/ IS features with the requirements of the external environment of the organization [13]. Finally, the third level of BITA is related to the organization's future changes [8]. Achieving BITA is noteworthy and considered to be an evolutionary and dynamic process, requiring strong support from senior management, mature relationships, powerful leadership, appropriate prioritization, trust, and effective communication, as well as a reciprocal understanding of the business and IT units [10].

2.2 ITIL

One possible way to achieve alignment is for IT organizations to transform themselves into service providers [12]. Being a service provider means using IT as a solution to business problems and running the IT department as a business function. It also means providing a new competitive strategy. This is because the focus of the companies moves toward customers and providing high quality products and services at low cost to satisfy their demands [13]. In order to be an effective service provider organizations are required to have high quality ITSM [12]. ITSM is "concerned with delivering and supporting IT services that are appropriate to the business requirements of the organization [14]. ITSM uses the best practice ITIL approach to improve delivery and support of IT services. ITIL will enable organizations to improve their IT service management [12]. Information Technology Infrastructure Library (ITIL) has introduced with Office of Government Commerce (OGC). It has three versions: ITIL Version 1, ITIL Version 2 and recently ITIL Version 3. After ten years use of ITIL V2, ITIL V3 was introduced in 2007 by OGC. The context of this publication of the ITIL is the ITIL framework as a source of good practice in service management. [15] For better understanding of ITIL, here some difference of ITIL V2 and V3 will be discussed. "ITIL Version 2 deals primarily with aligning IT to the business. but ITIL V3 will enable organizations to move from alignment of IT with the business to the integration of IT with the business". [16] The ITIL Version 3 Library has the following components [5]:

- **The ITIL Core:** There are five volumes as best practice guidance applicable which covers all types of organizations who provide services to a business. The structure of the core is in the form of a lifecycle (Figure 1). It is iterative and multidimensional.

• **The ITIL Complementary Guidance:** A complementary set of publications which are useful guides for industry sectors, organization types, operating models, and technology architectures.

The ITIL Core consists of five publications:

- Service Strategy
- Service Design
- Service Transition
- Service Operation
- Continual Service Improvement

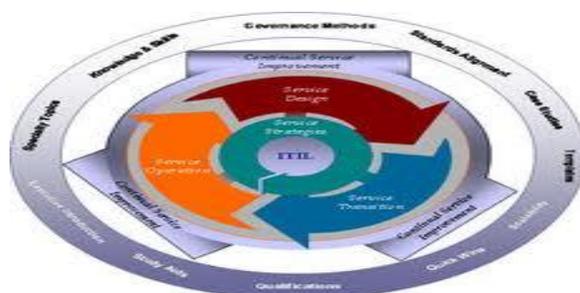


Fig. 1 Itil Framework

Table 1 The comparison of BITA models			
Scholar	Model	Characteristics	Alignment level
Henderson and Venkatraman (1993)	SAM	<ul style="list-style-type: none"> • Focusing on internal and external areas for both business and IT • Defining four domains: business strategy, IT strategy, organizational infrastructure and processes, IS infrastructure and processes • Defining vertical (strategic fitness) and horizontal (functional integration) relationships between four domains • Explaining four main alignment perspectives 	Current business
Clarke (1994)	Clarke	<ul style="list-style-type: none"> • Based on Scott Morton's five forces influencing the organization's objectives (Scott Morton 1991) • Including five factors: structure, management processes, individuals and roles, technology and strategy regard to the management process • Considering internal and external technological and socio-economic environments • Explaining an indirect relationship between IT and business strategy 	External needs
Yetton et al. (1994)	Fujitsu	<ul style="list-style-type: none"> • Based on Scott Morton's five forces influencing the organization's objectives (Scott Morton 1991) • Having a technology focused perspective • Focusing on IT as a driver to change 	External needs
Wegmann (2002)	SEAM	<ul style="list-style-type: none"> • Focusing on the resources of enterprise and its environment, and the processes • Considering four organizational levels: business, company, operation and technology • Proposing an iterative alignment process • Using three kinds of development activities: multi-level modeling, design and deployment 	External needs
van Eck et al. (2004)	GRAAL	<ul style="list-style-type: none"> • Consisting of four dimensions: life-cycle, aspects (internal and external), service layers and refinement • Considering four phases in the life-cycle: plan, design, realize and deploy • Focusing on business services, application services, platform services and network services • Cross checking with SAM (Henderson and Venkatraman 1993) 	Future business

Weiss and Anderson (2004)	4 C	<ul style="list-style-type: none"> Considering the value of IT in three levels: operational resource, strategic resource and strategic weapon Explaining four common themes of alignment under business/IT governance: clear direction, commitment, communication and cross-functional integration 	Current business
H. M. Chen et al. (2005)	BITAM	<ul style="list-style-type: none"> 12 steps method Focusing on architectural adaption, misalignment detection, and misalignment prevention Including three layers: business model, business architecture and IT architecture 	Future business
Derzsi and Gordijn (2005)	-	<ul style="list-style-type: none"> Using the value network (Allee 2008; Hakanson and Johanson 1992) approach Based on the concepts of service ontology Using e3 value model (Gordijn and Akkermans 2001, 2003) 	Current business
Bleistein et al. (2006)	B-SCP	<ul style="list-style-type: none"> Based on engineering requirements approach Validating IS requirements regarding alignment with strategy, context and processes Using goal models, Jackson problem diagrams and role activity diagrams (RAD) 	Current business
Versteeg and Bouwman (2006)	-	<ul style="list-style-type: none"> Focusing on business architecture Considering other three aspects of architecture: information, process and application Linking business strategy to business architecture Linking business architecture to other aspects 	Current business
Baïna et al. (2008)	Goal Model	<ul style="list-style-type: none"> Based on SAM (Henderson and Venkatraman 1993) Supporting Business Motivation Model (BMM) (TBRG 2007) 	Current business
Carvalho and Sousa (2008)	BISMAM	<ul style="list-style-type: none"> A holistic model Including three components: nomenclature, classification and Management Focusing on misalignment detection, correction and prevention 	Current business

Table 2 The comparison of the BITA maturity models

Scholar	Model	Characteristics	Cited
Luftman(2000)	Luftman	<ul style="list-style-type: none"> Qualitative approach Multi-level assessment Using Likert scale(1–5) Experienced in many organizations (Luftman 2000; Luftman and Kempaiah 2007) 	516
Papp(2001)	Papp	<ul style="list-style-type: none"> Qualitative approach Based on SAM (Henderson and Venkatraman 1993) Single-levelassessment Using Likert scale (1–7) 	62
Gutierrez et al. (2006)	-	<ul style="list-style-type: none"> Qualitative approach Based on Luftman’s model (Luftman 2000) Multi-level assessment Assessing strategic, tactical and operational alignment 	11
Silva et al (2006)	SBITA-TD	<ul style="list-style-type: none"> Quantitative approach Based on SAM (Henderson and Venkatraman 1993) Multi-level assessment 	10
Tapia (2007)	VITALMM	<ul style="list-style-type: none"> Qualitative approach Single-levelassessment Focusing on workflow structure, ITgovernance, enterprise architecture, IT/business processes, and coordination 	18

Few scholars have focused their research on the relationship between ITIL and BITA. Kashanchi (2006) presented Applying ITIL to the SAM model has determined that ITIL can impact on the four alignment perspectives introduced by the model. It has been identified that ITIL has the ability to impact business strategy and support it but not shape it. Also, it can impact and enhance IT strategy. In addition, ITIL can impact organizational infrastructure significantly. To a minimal extent it also has an impact on business processes. So it has the ability to improve alignment. Bagher Esmaili (2010) believed that ITIL plays two differences roles in business of organization. Generally IT services play a supportive role for business to meet the business strategies and goals and facilitate business maturity. Furthermore ITIL uses IT as an enabler and driver for business to recognize new initiatives. As explained earlier, no research has been conducted until now, to assess the effect of ITIL on achieving BITA in organizations and to discuss the domains of BITA most affected by ITIL. This study aims at examining the effect of ITIL in organizations on different aspects of their BITA, as well as to identify the limitations in developing ITIL frameworks that hinder organizations from achieving the expected BITA level so as to be able to propose some improvement points.

2.3 BITA maturity

The BITA maturity assessment provides organizations with a vehicle to evaluate their activities, which are performed to align business with IT [10]. Today, several maturity models are available to assess such an alignment. The BITA maturity models not only generally—meaning, not specifically—address the necessary issues to achieve BITA [7], but also make it possible for an organization to identify its position and plan improvement measures [10], by assessing the organization's maturity level and strategies to increase this level in the future. Some models measure the alignment to support its relevance, the impact of IT on business performance, and its relationship with financial benefits or business IT values. Other models aid in the understanding of the alignment events and assess it to improve the organization's current position. The more acceptable BITA maturity models, which are more frequently cited in the related researches, are presented by Luftman (2000), Papp (2001), Gutierrez et al. (2006), Silva et al. (2006), Tapia (2007), and Tapia et al (2007). A comparison of these models is given in Table 2. Citation of these models in other related studies was checked and counted by Google Scholar (Google). As the Luftman's model was found to be the most highly cited in the literature when compared with other BITA maturity models, it has been selected as the most valid and basic foundation of this study to evaluate the maturity level of BITA in the Iranian organization that have successfully completed their ITIL project.

2.4 Luftman's alignment maturity assessment model

Luftman's model [10] is the result of his extended researches, which he began by redefining the SAM model [17] followed by more detailed studies on the enablers and inhibitors of alignment [18], and it is completely consistent with his previous works. Using the same background, he concluded that the harmony prevalent among the 12 components of the SAM model is impacted by the six main components. The first component of the model is titled "communications." This criterion measures the effectiveness of the exchange of ideas, knowledge, and information between IT and business organizations, enabling both to clearly understand the organization's strategies, plans, business and IT environments, risks, priorities, and how to achieve them [10]. Many frameworks are applied to improve this measure [9] [17] [19]. "Competency/value measurements" is the second component of the Luftman's model. It employs analytics for assessing both IT and business organizations to demonstrate the contributions of information technology and the IT organization to the business in terms that are acceptable to both the business and IT [10]. Some BITA frameworks have been developed to cover this measure. The third component of the model is "governance." It defines who has the authority to make IT decisions, as well as the types of processes IT and business managers employ at strategic, tactical, and operational levels to set IT priorities for allocating IT resources [10]. IT governance is defined as "specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT" [19] and considers decisions, decision-makers, and decision-making processes related to IT. This term has recently been modified to an approach to achieve BITA [8]. Moreover, some frameworks have been developed to establish it within the organization [5]. The fourth component of the Luftman's model is "partnership." This criterion evaluates the relationship between business and IT organizations, including the role of IT in defining business strategies, the degree of trust existing between them, and how each perceives the other's contribution [10]. This component is the key to motivate the development of some recent BITA frameworks. "Scope and architecture" is the fifth component of the model which measures IT's provision of a flexible infrastructure, its evaluation and application of emerging technologies, its ability to enable or drive business process changes, and its delivery of valuable customized solutions to internal business units and external customers or partners [10]. Similar to the assessment of communications, architectural concerns are the main motivation of several BITA frameworks [8].

The last component of the Luftman's model is "skills." It considers and measures human resources practices, such as the hiring, retention, training, and performance feedback mechanism, encouraging innovation and career opportunities, and developing the skills of the employees [10]. It also measures the organization's readiness for change, capability for learning, and ability to adopt and adapt to new ideas. It appears that some BITA frameworks [9] have had a glance on this measure. As practiced in many maturity models, the scores an organization achieves for these six components of maturity are drawn up on the core concepts of the Software Engineering Institute's capability maturity metric (CMM) and are based on a five-point Likert scale. These five levels of maturity are signified as below [10]:

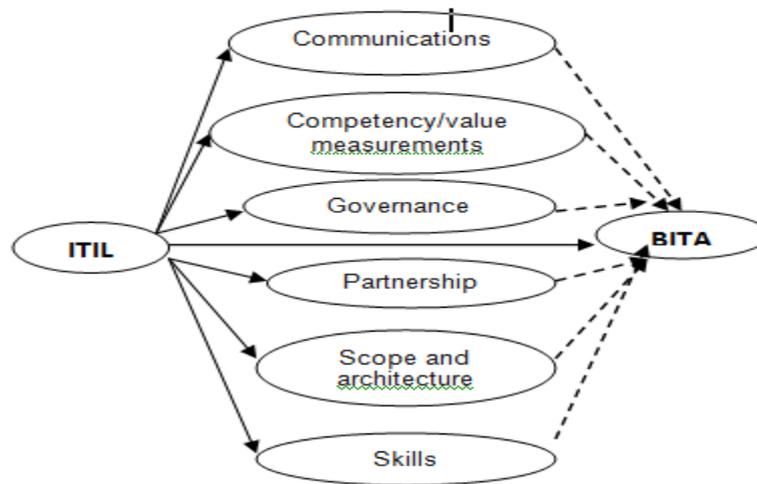
1. Initial/ad-hoc process
2. Committed process
3. Established focused process
4. Improved/managed process
5. Optimized process

III. Research Model And Methodology

- Hypothesis 1:** The communications between the various parts of the business and IT in an organization and their awareness of each other (communications) can be improved by running an ITIL Framework.
- Hypothesis 2:** Conducting an ITIL Framework will positively influence the demonstration of IT values to the business in terms that the business understands Competency/ value measurements).
- Hypothesis 3:** Conducting an ITIL Framework will positively influence the IT decision-making, IT prioritization and IT resource allocation (governance).
- Hypothesis 4:** The relationships between the business and IT units in an organization including their partnership on the risks and benefits (partnership) will be positively influenced by running an ITIL Framework.
- Hypothesis 5:** Conducting an ITIL Framework has a positive impact on the standardization , integration and managing the business needs (scope and architecture).
- Hypothesis 6:** Running an ITIL Framework in the organization will positively influence the human resource considerations (skills).

If hypotheses 1 to 6 are true, then automatically the main proposition of the study (i.e. conducting an ITIL Framework positively impacts the BITA maturity) will hold true and by virtue of this, the moment one of them is false, the main proposition will also be false. To address the research hypotheses, a survey of organization in Iran that recently ran and completed an ITIL Framework between 2011 and 2012 was conducted. The qualitative approach was adopted for this research because of the small sample size. The research methodology in this study involved presenting a questionnaire listing 39 questions, based on six components and their measures corresponding to the Luftman's model, to evaluate the BITA maturity in a valid manner, in each organization. This questionnaire included two similar parts: one to be answered before implementation of the ITIL Framework and Earlier, to score each of the 39 questions, respondents had been requested to select an option from a multiple choice list of five statements. These five statements were designed to represent a continuum from the first, signifying the lowest level of alignment maturity to the fifth statement, signifying the highest level. In the next step, these selected options were mapped to the scores 1 to 5. Thus, the systemized concepts were utilized instead of subjective numbers, to increase the validity of each measurement [11]. The six measures of the BITA maturity described earlier were used. As mentioned above, CIOs were requested to respond by selecting the item that most accurately described the BITA scenario of their organization, before and after conducting the ITIL Framework there. Their responses were then analyzed. The matching calculation utilized the differences between the corresponding factors in the two states. Furthermore, the research hypotheses of this study postulated that conducting the ITIL would definitely enhance the maturity of BITA in organizations. To address these hypotheses, the mean of these enhancements in each six measure were employed and the results sorted out. The research model in this study is shown in Fig. 2. Statistical analyses were performed by SPSS. Prior to data analysis, the research instrument was assessed for reliability as well as validity. It appeared that the research tool would be valid because a questionnaire containing 39 Luftman's standard measures ,was used. Moreover, Cronbach's alpha was employed to analyze the reliability of this tool. Regarding the hypotheses of the research, this data was also analyzed by the t-test for paired samples , and significant results explained in the next section, were identified.

Fig. 2 Research model of the relationship between EA and BITA



IV. Data And Results

4.1 Data collection, validation and verification

A two-part questionnaire, including a complete description of our purpose, ITIL Framework definition, the organizational scale of the project, and 39 questions based on the Luftman's model, was prepared in Microsoft Excel format and distribute it to municipality IT organization Of Tehran. 50clerks of the organization selected were requested to answer the questions, once before conducting the ITIL Framework and once again after deployment. Finally, 33 clerks responded with completed questionnaires for both states, after our follow-up, in six months. Eventually, the verified data was imported into SPSS. The frequencies of the observed measures are shown in Table 6 of Appendix A. Figure 3 shows the line graphs for each of the six main criteria of the Luftman's model. As shown in these graphs, all measures show a conspicuous improvement in their maturity scores after conducting the ITIL Framework.

4.2 Construct validity

Construct validity is the degree to which the variables employed in the study accurately measure the concepts they purport to measure [21]. It basically refers to this question, "Are the theory and information sources used in the study adequate?" In qualitative research, construct validity involves the development of a set of measures to collect data [22], and ensures that the study focuses on specific factors related to research objectives [23]. The original source for the metrics was considered a well-known framework to assess the BITA maturity, and the information proceeding from it should be valid because the variables were derived from an instrument that had been successfully applied in a similar study type [11]. Moreover, construct validity was met by utilizing multiple sources of evidence. In this investigation, the authors used several different sources of data to answer the research questions. The sources included documentation, workforce interviews, and observation of firms. Data collection focused on specific IT projects and the organization's operations related to the criteria of the research model, rather than to all their processes.

4.3 Internal validity

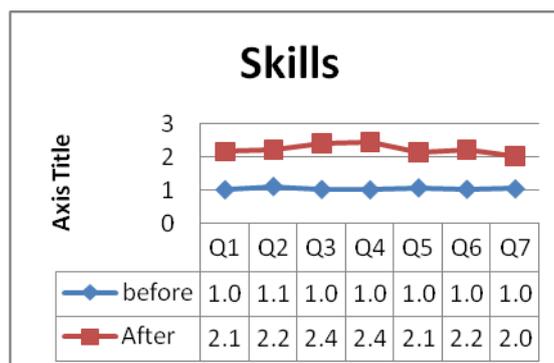
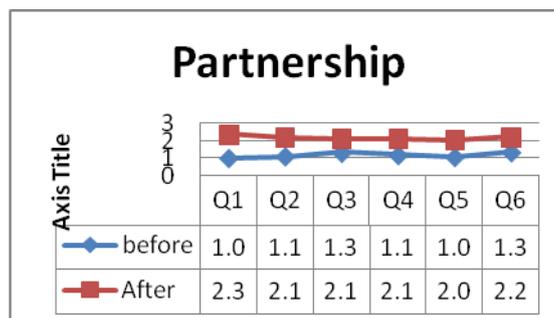
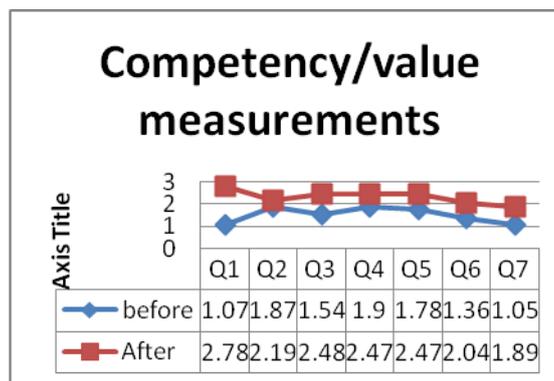
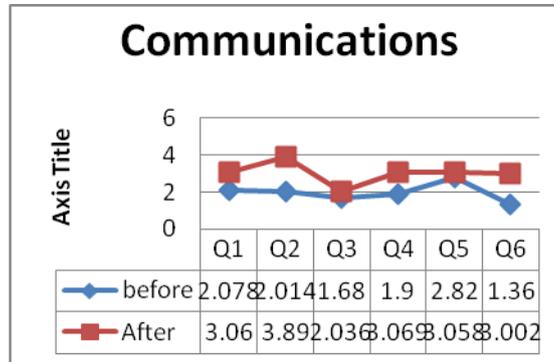
Internal validity is most relevant in causal studies, where the researcher attempts to determine specific actions leading to predicted results [22], and refers to this question, "Was the intended answer really selected?" In causal studies, internal validity requires that all possible cause and effect relationships are accounted for in the methodology design. The methodology accounted for the internal validity by utilizing multiple sources that were triangulated against the aim of the study to determine how CIOs could assess the alignment between business and IT in their organizations by employing a set of selected criteria. Feedback from interviews showed that the selected measures had adapted well to the CIOs' insights, which ensured that the proper metrics had been selected and customized. This was understood by comparing the results obtained from the respondents and the outcomes from investigating other sources of evidence.

4.4 External validity

External validity depends on whether the results of a study can be generalized and applied to other, similar cases [22], and raises the question, "Can the results and findings of a study be generalized?" To achieve

such types of validity, the thesis of the research needs to be applicable to each organization and similar results should be gained. The subjects participating in this experiment were all CIOs from one Iranian organization(municipality IT organization Of Tehran), holding very high ranks. The results of the study were expected to be, to

Fig. 3 Line graph for BITA Components



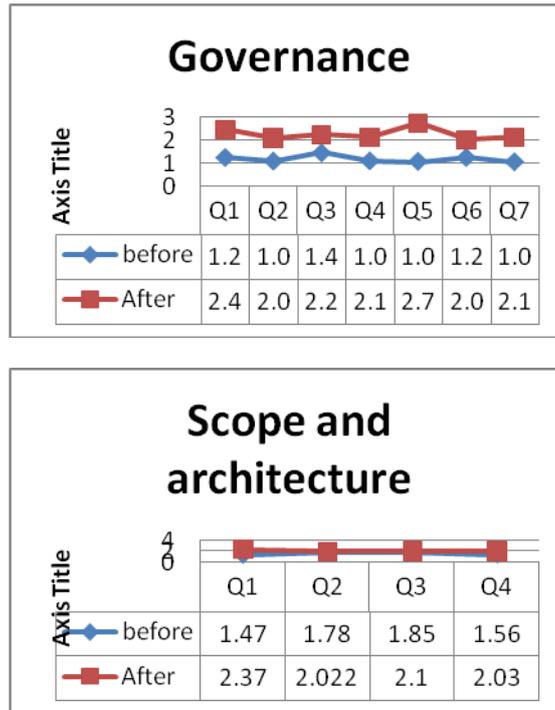
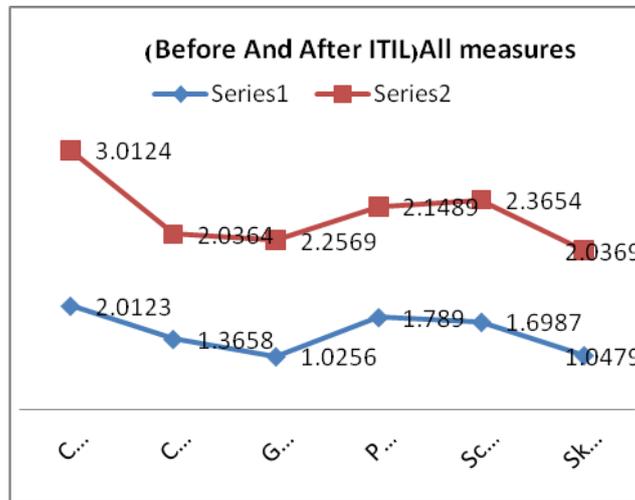


Fig. 4 Line graph for all measures



some degree, representative of this class of subjects. Any generalization of the results regarding organization size or even type needs to be made cautiously. However, what should be emphasized is that the research presented in its current stage is exploratory in nature and merely the first step in a series of experiments, which could yield results which will prove amenable to more generalization, in the future.

4.5 Reliability

The reliability of a study design refers to the ability of an instrument to consistently measure an attribute, and ensures that a different researcher conducting exactly the same study, employing the same methodology on the exact same participants would end-up with the same results [22]. This implies that the experiment is replicable [21]. As mentioned earlier, Cronbach's alpha, which is the measure of internal consistency or reliability of a psychometric test score for a sample of examinees, was applied to analyze the reliability of different sections of the questionnaire. Alpha can take on any value less than or equal to 1, including negative values, although only the positive values make sense. The higher values of alpha are more desirable [24]. The α coefficient was found to be **0.826** for "before ITIL" and **0.879** for "after ITIL," therefore, two parts of the questionnaire were reliable because the values of α in both cases were well above the acceptable

threshold, at 0.8 [25].Based on the results of assessing reliability and validity, statistical analyses could be executed on the collected data.

4.6 Test results

Descriptive statistics

The descriptive statistics of the research variables are presented in Table 3. Figure 4 shows the overall line graph for the six main components of the Luftman's model in an Iranian organization (municipality IT organization Of Tehran). As shown in Table 3 and Fig. 4, the BITA maturity level shows meaningful growth in all measures and in the organization after performing ITIL compared with the state prior to the ITIL initiative. Furthermore, the same gradient of measure lines and the consistent shift, visible in both the ITIL Framework implementation states, show similar trends of improvement in all the questionnaires.

4.7 Test of the research proposition

As the two groups of variables (i.e. before and after ITIL), which were suggested by one person, needed to be compared, the paired-samples t-test [27] was used to test the research proposition of the study. Therefore, two expected hypotheses were drawn up as stated below: H0: performing ITIL Framework cannot change BITA maturity ($\mu_{after} = \mu_{before}$). H1: performing ITIL Framework can change BITA maturity ($\mu_{after} \neq \mu_{before}$). If the significance level value was higher than 0.05, hypothesis H0 would be asserted; else, if it were less than 0.05, hypothesis H1 would be proven. This implies that running ITIL Framework can improve BITA maturity. This test was also applied to each of the six main components of the Luftman's model, in a similar manner. Table 4 shows the results of the tests. As shown in Table 4, the significant level values of all the six components were less than 0.05. This explains the significant difference prevalent between the two states of the study. Therefore, conducting ITIL Framework was proven to have a positive effect on all BITA maturity aspects and improved it.

V. Discussion

Beginning with the results presented in this section, interpretations and possible

Table 3 Descriptive statistics of the research variables

Variables (Before)	Mean	Standard Deviation	Median	Max	Min
Communications	2.0123	0.573	2.0012	3.49	1.00
Competency/value measurements	1.3658	0.693	1.1236	2.14	1.03
Governance	1.0256	0.785	0.9869	3.00	1.12
Partnership	1.7890	0.384	1.8975	2.03	1.14
Scope and architecture	1.6987	0.326	1.7962	2.14	1.00
Skills	1.0479	0.976	1.0136	2.36	1.00
Variables (After)	Mean	Standard Deviation	Median	Max	Min
Communications	3.0124	0.147	2.8975	4.03	1.36
Competency/value measurements	2.0364	0.092	1.7692	3.19	1.42
Governance	2.2569	0.263	2.0136	4.42	1.46
Partnership	2.1489	0.746	2.0013	2.56	1.78
Scope and architecture	2.3654	0.726	2.2364	3.85	1.69
Skills	2.0369	0.299	2.1369	2.79	1.81

Table 4 Testing the proposition of the study

Variables	Significance	Sig < *	t value	Asserted hypothesis
Communications	0.00	0.05	-7.485	H1
Competency/value measurements	0.00	0.05	-10.967	H1
Governance	0.00	0.05	-9.313	H1
Partnership	0.00	0.05	-8.823	H1
Scope and architecture	0.00	0.05	-11.823	H1
Skills	0.00	0.05	-7.163	H1
Total	0.00	0.05	-11.403	H1

Table 5 Descriptive statistics of the differences between two states of main measures

BITA maturity components (differences)	Mean	Standard Deviation	Median	Max	Min
<i>Communications</i>	1.0001	-0.426	0.896	0.54	0.36
<i>Competency/value measurements</i>	0.6706	-0.601	0.646	1.05	0.39
<i>Governance</i>	1.2313	-0.522	1.027	1.42	0.34
<i>Partnership</i>	0.3599	0.362	0.104	0.53	0.64
<i>Scope and architecture</i>	0.6667	0.4	0.440	1.71	0.69
<i>Skills</i>	0.989	-0.677	1.124	0.43	0.81
<i>Total</i>	0.8196	0.5698	0.706	0.93	0.36

explanations of the outcomes of the experiment are mentioned below. Testing the positive effect of the ITIL Framework on BITA confirmed a statistically significantly beneficial impact on the change of scores from “before ITIL” to “after ITIL” for the variables of the BITA maturity. This provided ample evidence for the assumption that an ITIL Framework can play an effective role in BITA improvement. Moreover, comparing the values listed under column “mean” for similar variables in Table 3 reveals that the differences between both statuses differs from one BITA domain to another. However, no identical effects were identified for different variables, although running an ITIL Framework was assumed to be an excellent tool to increase the BITA maturity. Table 5 shows descriptive statistics of the differences between the two states of the main criteria. Based on the values of “mean” in Table 5, the effect of an ITIL Framework on each component of BITA maturity is listed as below:

1. Governance (1.2313)
2. Communications (1.0001)
3. Skills (0.989)
4. Competency/value measurements (0.6706)
5. Scope and architecture (0.6667)
6. Partnership (0.3599)

It is also clearly understood from Table 6 of Appendix A that a totally meaningful movement has occurred from levels 1 and 2 to levels 3 and 4 of the maturity scores.

VI. Conclusions

Performance evaluation of enterprise architecture in aligning business and information technology is the main purpose of this study. To achieve this goal, An Iranian governmental organization which had successfully completed an ITIL Framework since 2011 was selected, and their BITA maturity was assessed as an effective method of evaluating the alignment between business and IT. A two-part questionnaire based on criteria of the Luftman’s model was prepared and sent out to the selected organization. Fully completed questionnaires that had been received were revised cooperatively and used in the final analyses. Although this study is a significant contribution, particularly to both ITIL and business-IT alignment research as it reveals the relationship between the successful ITIL deployment and the BITA maturity, additional works are required to examine why the factors “Partnership” and “Scope and architecture” contributed less significantly to the respondents’ self-rated maturity level. This could be attributed to the small size of the study sample (only One organization), excluding the IT and business executives participants in this survey, or for other reasons yet undiscovered, and which should ideally be identified through a more thorough study based on the larger amount of data.

Appendix A. Collected data based on the Luftman’s model

Table 6 shows the frequencies of the observed data in this survey. This data was collected from one Iranian organization for two states: before performing their ITIL Framework and after that.

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Difference	Mean	Scores					Status of ITIL	BITA maturity measures(Communications)	
		5	4	3	2	1			
0.97	1.57	0	0	1	17	15	N	Before	Understanding of business by IT
		0.0	0.0	3.03	51.51	45.45	%		
2.54	2.54	0	0	18	15	0	فراوانی	After	
		0.0	0.0	54.55	45.45	0.0	%		
0.85	1.66	0	0	3	16	14	N	Before	Understanding of IT by business
		0.0	0.0	9.09	48.48	42.42	%		
2.51	2.51	0	0	17	16	0	N	After	
		0.0	0.0	51.51	48.48	0.0	%		
0.76	1.75	0	1	2	18	12	N	Before	Inter/intra-organizational learning
		0.0	3.03	6.06	54.55	36.36	%		
2.51	2.51	0	0	18	14	1	N	After	
		0.0	0.0	54.55	42.42	3.03	%		
0.52	1.75	0	0	3	19	11	N	Before	Protocol rigidity
		0.0	0.0	3.03	57.57	33.33	%		
2.27	2.27	0	1	13	13	6	N	After	
		0.0	3.03	39.39	39.39	18.18	%		
1.00	1.61	0	0	1	18	14	N	Before	Knowledge sharing
		0.0	0.0	3.03	54.54	42.42	%		
2.61	2.61	0	0	21	11	1	N	After	
		0.0	0.0	63.63	33.33	3.03	%		
1.18	1.51	0	0	0	17	16	N	Before	Liaison(s) breadth/effectiveness
		0.0	0.0	0.0	51.51	48.48	%		
2.69	2.69	0	2	19	12	0	N	After	
		0.0	6.06	57.57	36.36	0.0	%		
Difference	Mean	Scores					Status of ITIL	BITA maturity measures(Competency)	
		5	4	3	2	1			
0.45	1.12	0	0	0	4	29	N	Before	IT metrics
		0.0	0.0	0.0	12.12	87.87	%		
1.57	1.57	0	0	0	19	14	N	After	
		0.0	0.0	0.0	57.57	42.42	%		
0.18	1.33	0	0	0	11	22	N	Before	Business metrics
		0.0	0.0	0.0	33.33	66.66	%		
1.51	1.51	0	0	0	17	16	N	After	
		0.0	0.0	0.0	51.51	48.48	%		
0.3	1.39	0	0	0	13	20	N	Before	Balanced metrics
		0.0	0.0	0.0	39.39	60.60	%		
1.69	1.69	0	0	0	23	10	N	After	
		0.0	0.0	0.0	69.69	30.30	%		
0.22	1.54	0	0	1	16	16	N	Before	Service level agreements
		0.0	0.0	3.03	48.48	48.48	%		
1.76	1.76	0	0	2	21	10	N	After	
		0.0	0.0	6.06	63.63	30.30	%		
0.31	1.36	0	0	0	12	21	N	Before	Benchmarking
		0.0	0.0	0.0	36.36	63.63	%		
1.67	1.67	0	0	0	22	11	N	After	
		0.0	0.0	0.0	66.66	33.33	%		
0.25	1.36	0	0	0	12	21	N	Before	Formal assessments/reviews
		0.0	0.0	0.0	36.36	63.63	%		
1.61	1.61	0	0	0	20	13	N	After	
		0.0	0.0	0.0	60.60	39.39	%		
0.19	1.48	0	0	1	14	18	N	Before	Continuous improvement
		0.0	0.0	3.03	42.42	54.54	%		
1.67	1.67	0	0	2	18	13	N	After	
		0.0	0.0	6.06	54.54	39.39	%		
Difference	Mean	Scores					Status of ITIL	BITA maturity measures(Governance)	
		5	4	3	2	1			
0.51	1.51	0	0	3	11	19	N	Before	Business strategic planning
		0.0	0.0	9.09	33.33	37.5	%		
2.00	2.00	0	0	4	25	4	N	After	
		0.0	0.0	12.12	75.75	12.12	%		
0.68	2.51	0	0	14	12	17	N	Before	IT strategic planning
		0.0	0.0	42.42	36.36	51.51	%		
3.19	3.19	0	0	2	28	3	N	After	
		0.0	0.0	6.06	84.84	9.09	%		
0.55	1.42	0	0	2	10	21	N	Before	Reporting/organization structure
		0.0	0.0	6.06	30.30	63.63	%		
1.97	1.97	0	1	2	25	5	N	After	
		0.0	3.03	6.06	75.75	15.15	%		
0.51	1.51	0	0	2	13	18	N	Before	Budgetary control
		0.0	0.0	6.06	39.39	54.54	%		
2.00	2.00	0	0	2	29	2	N	After	
		0.0	0.0	6.06	87.87	6.06	%		
0.49	1.33	0	0	0	11	22	N	Before	IT investment management
		0.0	0.0	0.0	33.33	66.66	%		
1.82	1.82	0	0	0	27	6	N	After	
		0.0	0.0	0.0	81.81	18.18	%		

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0.34	1.51	0	0	0	17	16	N	Before	Steering committee(s)
		0.0	0.0	0.0	51.51	48.48	%		
	1.85	0	0	0	28	5	N	After	
		0.0	0.0	0.0	84.84	15.15	%		
0.25	1.54	0	0	4	10	19	N	Before	Prioritization process
		0.0	0.0	12.12	30.30	57.57	%		
	1.79	0	0	0	26	7	N	After	
		0.0	0.0	0.0	78.78	21.21	%		
Difference	Mean	Scores						Status of ITIL	BITA maturity measures(Partnership)
		5	4	3	2	1			
0.25	1.48	0	0	0	16	17	N	Before	Business perception of IT value
		0.0	0.0	0.0	48.48	51.51	%		
	1.73	0	0	7	10	16	N	After	
		0.0	0.0	56.3	30.30	48.48	%		
0.43	1.48	0	0	1	14	18	N	Before	Role of IT in strategic business planning
		0.0	0.0	3.03	42.42	54.54	%		
	1.91	0	1	7	13	12	N	After	
		0.0	3.03	21.21	39.39	36.36	%		
0.22	1.54	0	0	1	16	16	N	Before	Shared goals, risk, rewards/penalties
		0.0	0.0	3.03	48.48	48.48	%		
	1.76	0	0	6	14	12	N	After	
		0.0	0.0	18.18	42.42	36.36	%		
0.07	1.54	0	0	3	12	18	N	Before	IT program management
		0.0	0.0	9.09	36.36	54.54	%		
	1.61	0	0	1	18	14	N	After	
		0.0	0.0	3.03	54.54	42.42	%		
0.25	1.51	0	0	3	11	19	N	Before	Relationship/trust style
		0.0	0.0	9.09	33.33	57.57	%		
	1.76	0	2	1	17	13	N	After	
		0.0	6.06	3.03	51.51	39.39	%		
0.36	1.51	0	0	2	13	18	N	Before	Business sponsor/champion
		0.0	0.0	6.06	39.39	54.54	%		
	1.89	0	2	2	17	12	N	After	
		0.0	6.06	6.06	51.51	36.36	درصد		
Difference	Mean	Scores						Status of ITIL	BITA maturity measures(Scope and architecture)
		5	4	3	2	1			
0.70	1.21	0	0	0	7	26	N	Before	Traditional, enabler/driver, external
		0.0	0.0	0.0	21.21	78.78	%		
	1.91	0	0	7	16	10	N	After	
		0.0	0.0	21.21	48.48	30.30	%		
0.70	1.24	0	0	0	8	25	N	Before	Standards articulation
		0.0	0.0	0.0	24.24	75.75	%		
	1.94	0	0	7	16	11	N	After	
		0.0	0.0	21.21	48.48	33.33	%		
0.37	1.39	0	0	2	9	22	N	Before	Architectural integration (functional organization)
		0.0	0.0	6.06	27.27	66.66	%		
	1.76	0	2	1	17	13	N	After	
		0.0	6.06	3.03	51.51	39.39	%		
0.55	1.33	0	0	1	9	23	N	Before	Architectural integration (enterprise)
		0.0	0.0	3.03	27.27	69.69	%		
	1.88	0	1	5	16	11	N	After	
		0.0	3.03	15.15	48.48	33.33	%		
0.49	1.30	0	0	1	8	24	N	Before	Architectural integration (inter-enterprise)
		0.0	0.0	3.03	24.24	72.72	%		
	1.79	0	0	5	16	12	N	After	
		0.0	0.0	15.15	48.48	36.36	%		
0.34	1.42	0	0	2	10	21	N	Before	Architectural transparency, flexibility
		0.0	0.0	6.06	30.30	63.63	%		
	1.76	0	2	2	15	14	N	After	
		0.0	6.06	6.06	45.45	42.42	%		
Difference	Mean	Scores						Status of ITIL	BITA maturity measures(Skills)
		5	4	3	2	1			
0.64	1.30	0	0	3	4	26	N	Before	Innovation, entrepreneurship
		0.0	0.0	9.09	12.12	78.78	%		
	1.94	0	0	9	13	11	N	After	
		0.0	0.0	27.27	39.39	33.33	%		
0.43	1.48	0	0	5	6	22	N	Before	Locus of power
		0.0	0.0	15.15	18.18	66.66	%		
	1.91	0	2	6	12	13	N	After	
		0.0	6.06	18.18	36.36	39.39	%		
0.34	1.39	0	1	3	5	23	N	Before	Management style
		0.0	3.03	9.09	15.15	69.69	%		
	1.73	0	0	5	14	14	N	After	
		0.0	0.0	15.15	42.42	42.42	%		
0.52	1.27	0	0	1	7	25	N	Before	Change readiness
		0.0	0.0	3.03	21.21	75.75	%		
	1.79	0	0	5	16	12	N	After	
		0.0	0.0	0.0	0.0	0.0	0.0		

		0.0	0.0	15.15	48.48	36.36	%		
1.51	1.51	0	0	5	7	21	N	Before	Career crossover
		0.0	0.0	15.15	21.21	63.63	%		
	2.00	0	4	3	15	11	N	After	
		0.0	12.12	9.09	45.45	33.33	%		
0.34	1.36	0	0	3	6	24	N	Before	Education, cross-training
		0.0	0.0	9.09	18.18	72.72	%		
	1.70	0	1	3	14	15	N	After	
		0.0	3.03	9.09	42.42	45.45	%		
0.67	1.21	0	0	0	7	26	N	Before	Social, political, trusting environment
		0.0	0.0	0.0	21.21	78.78	%		
	1.88	0	4	2	16	11	N	After	
		0.0	12.12	6.06	48.48	33.33	%		

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