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Impact of Requirement Changes on Business Processes of Projects in ICT Sector of Pakistan

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Abstract

Purpose: This paper on requirement changes and their impact identifies those factors which have influence over standard operation procedures in an organization.

Design/Methodology/Approach: Qualitative and quantitative approaches are described in this paper along with their merits and demerits. Primary data was collected by using questionnaire as instrument. Secondary data was collected from already published literature.

Findings: Outcomes and analysis shows that there is a strong and positive relation between requirement changes in software industry and changes in technical SOPs. The mediating factor of technology culture also play a role in strong and positive relation between requirement changes in projects which are conducting in software industry and changes in technical SOPs.

Practical Implications: This research is designed to uncover the challenges that are faced by IT organizations due to changes in requirements during ongoing processes in projects. This study is of significance importance to IT industry as it will generate such outcomes which if practically implemented can lead to solution of many problems which are troubling the organizations of this industry quite seriously.

Originality/Value: Through this empirical study researcher infer that requirements should be collected in complete and precise manner before execution. If there are some changes in the middle of the project then those changes should be addressed through proper mechanism and procedure.

Keywords: Requirement changes in software industry; Technology culture; Standard operative procedures (SOPs)

Introduction

This research is designed to uncover the challenges which are faced by IT organizations due to changes in requirements during ongoing processes and projects. This study is of significance importance to IT industry as it will generate such outcomes which if practically implemented can lead to solution of many problems which are troubling the organizations of this industry quite seriously. Requirement changes in form of authorized changes or in the form of scope creep or feature creep always bring modifications in resources, schedules and budget. The product availability, features, aesthetics and costing is changed with changed technology and transformation in the marketplace occurs. Also a change in technology demands skilled and flexible workforce in specific areas [1]. Mainly, this study focuses on requirement changes and their effects on business processes or standard operation procedures of software projects. To keep requirement changes minimal, software development organizations should clearly focus on initial requirement document. This document has been established to record all the needs from the client. During the execution phase of project the requirement changes effect triple constraints (scope, schedules and costs) of projects. In this research an effort has been made to unveil those factors that are causes of requirement changes and their effects on business processes of projects. Also researcher has tried to find the solutions for scope creep and minimize its effect.

Background

In software developer's life it is an inevitable fact that changes will come in a project or product. An empirical study by Edberg, Olfman suggests that there are different factors that are accounted for change requests. In these factors 10-15% of rework is described as bug fixing while 60% of work is done for enhancement. This enhancement work or change is categorized in following four phases.

1. Changes through learning that come from groups or individuals.
2. Changes that is required via technical demands.
3. Changes that is required because of internal changes for restructuring or new products (Internal changes).
4. Changes that is required because of legal issues or need of other stakeholders (External changes).

To address effective changes in the organizations there must be a change control process that will be used to properly address the change. Finding out the change origin is also a must doing thing to encompass change requests. In software projects change can come from any stakeholder, it can be arisen by customer for value addition or by tester or quality assurance person as a bug or improvement. So to cater changes, change control board (CCB) are established in organizations that include almost all the prime stakeholders of project like a project manager, tester, higher management person for approval or rejection of change request and a person from customer side who knows about the procedural work regarding the project or product under development.

In this particular research, researcher has studied different factors that are involved in initiating a change and tried to find the impacts of

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those changes. For this purpose different sort of relevant literature was studied that was in favor requirement changes, technology culture and their impact on business processes or standard operation procedures of projects.

To strengthen the research process, researcher has developed a survey mechanism in the form of questionnaire that was validated by experts from academia and business enterprises. Questionnaire was composed of different question relevant to the research variables and analysis was made on the basis of that survey.

Broad problem area

It is evident from recent history that there are no way out from the requirement changes in software industry. These changes may come in the form of scope creep, feature creep, design changes or overall restructuring in the form of plan change. A statement has been prevailed in software sector that requirement changes is just like a monster for projects and most of the projects fail due to vague requirements. These scope creeps sometimes sabotage the whole processes of ongoing software projects. Many examples are available in software industry where these changes have played vital role in closing projects before completion. Cost and schedules overrun are also taken in account for changes that has to be deployed for a particular software project or product. Most of the software houses in this region are based on offshore work or providing services to foreign client. With the completion of a change request timely and within budget lead many processes to low quality solutions. In this particular research, it is tried to find of factors that bring changes and to cater those changes in such a way to lead projects towards successful completion.

Specific problem statement

Every organization in the software industry has to implement a policy of gathering initial requirement in detail from the customer in regard to fulfill the needs of customer. Meeting the customer's need must be prime priority for service providers and exceeding these needs provide delight and satisfaction to customer. While doing a project there are obstruct in the form of requirement changes. There are factors in the form of resistance, organization politics, technology changes and fluctuation in economy that arise obstruction in change policies. Changes in the requirement are most commonly considered cost and time effective but in the long run these changes are beneficial for organization. This research has been conducted to solve problems that are faced by people in the form resistance, organization politics, technology changes and fluctuation in economy.

Aim of study

Researcher has intended to conduct this research with the aims of studying the impact of requirement changes on ongoing business process and projects in IT industrial sector. Aim of the research is to establish criteria for proper requirement documentation by conducting different pre project sessions with customer. Proper requirement document makes life easier for project team and if a change request has been received from customer that should be properly analyzed in a change control process for proper acceptance or rejection. The research is mainly aiming to improve business processes of ICT (mainly software industry) sector of Pakistan.

Research objectives

To get to the research aims, researcher will have to achieve following objectives:

- To collect relevant, necessary and authentic information and to analyze it while being unbiased so that genuine results can be generated and real solution to the problem in hand can be sought out
- To accumulate data regarding the requirement changes whether in the form of unapproved changes i.e. scope creep or approved changes
- To find out technological culture that is prevailed within the organizations and their influence on business procedure when a change occurs
- To find out factors that are affecting standard operating procedures or business processes of projects

On the basis of above mentioned points a conclusion will be drawn regarding standard operating procedures (SOPs), to find out whether the requirement changes in ICT sector and technology culture are positively affecting standard operating procedures or not

Research question

This research is going to seek for the answer of following research question:

- How requirement changes influences the performance of ongoing business process or standard operating procedures (SOPs) of projects in IT sector?
- How technology culture influences the performance of ongoing business process or standard operating procedures (SOPs) of projects in IT sector?
- What are the factors that are affected by changing technical SOPs (Standard operating procedures)

Research overview

Research is a process of quest in persuasion of a goal or objective. It has to be conducted in careful manner due to its importance, complications and delicate philosophy. The researcher objective and aims may be diverted by any carelessness of data analysis or biasness, thus resulting in leading towards wrong directions. Research should be conducted in sequential manner because the processes in research are multistep where significance of each and every step should be realized. This particular research paper is a manuscript written by the researcher after making efforts to achieve the research objectives and aims. Documentation has been performed by researcher for each chapter of this particular research.

In the first chapter introduction to the research area along with background of research has been documented. Researcher has further described the broad problem area with problem statement, aims of research, objectives of research and research question. Research aims, research objectives and research questions are elaborated in a clear way that the reader might not found any difficulty while interpreting and understating the goals and purpose of this particular research. An overview at the end of this chapter has been presented for discussion of overall structure and processes of this particular research paper.

The research being conducted for this paper is purely for academia and the foundation of this particular research has been laid on the basis of facts and figures present in already developed literature. For the said reason of conducting research on impact of requirement changes, helping materials are taken from different sources as a secondary data.

Articles, reports, journals and books were consulted by researcher to avail best possible authentic and reliable data about the problem in hand. In literature review chapter all the reviewed data is cited for this particular research paper.

After collection and analysis of the facts taken from different secondary data sources, primary data was collected by researcher from different ICT organizations mainly from software industry. For primary data collection questionnaire was developed by researcher. Expert content validity was performed by experts from academia and practitioner content validity was performed by experts from software industry. Questionnaire was designed in close ended form and the context of questions was kept simple for better understanding of respondent. Questionnaire was distributed among different respondents performing various roles in their organization. Responses from various respondents were carefully tabulated without any biasness.

In the third chapter methods for conducting this particular research has been elaborated along with research design, paradigms of research, approaches used for research, research parameters and ethical considerations.

In the fourth chapter of this research findings are discussed in detail and analysis has been made in regard of data collected. SPSS has been used as an analysis tool on the basis of data obtained from survey in the form of questionnaire. Findings are presented in the form of tables and graphs to depict the true nature of results.

In the fifth chapter a conclusion has been drawn on the basis of research findings that are extracted from questionnaire and data cited from various sources. Recommendations are also included in this chapter. Limitations in the form of time are elaborated. Future prospects of this particular research are also described in this chapter. Appendices and references are documented at the end of paper which shows significance of this research in the form of authenticity.

Literature Review

For this particular research, researcher had developed a criterion for source of information regarding the requirement changes, technology culture and changes in technical SOPs. For this process of accumulating secondary data different journals, articles and books were reviewed. Citation of relevant data has been accomplished in this section after critically analyzing the whole data keeping in mind different aspects of specific fields.

Requirement changes in software industry

A fact of life is change. Many people in IT sector shows resistance to change but in fact requirement changes are part of IT projects. For realistic adaptation of change, there are change control bodies in organizations to control effects of change. In this particular research it is taken in consideration that requirement changes play a significant role in affecting business processes of software projects. For this purpose literature from past are reviewed and included in the research.

It is widely acknowledged that requirements volatility is inevitable and that it causes difficulties during the software development lifecycle [2]. As a major source of risk, the impact of Requirement changes is often underestimated; particularly the impact of small changes to requirements in the later stages of the development lifecycle. It is one of the most important cost drivers [3].

Cockburn [4] suggests that adding new requirements at the later stages of development required substantial effort. Hence, it is the later, very expensive changes that the organization should pay attention to Chow and Cao [5]. In addition to that change types, requirements changes due to Defect fix, Product Strategy, and Missing requirements are considered to be of the expensive change type [6].

Edwards [7] sums up the effects of organizational pressure and unhappiness of higher management for changes in organization and their unsupported actions with their team mates and supervisors. Senior management are capable of setting guidelines for change in organizations, with the help of coalition developed for new principles different groups of individuals work together either for a success or loss in projects. For win or loss changes require coalition and negotiations.

There are several other factors which are vulnerable for projects and most critical is change in scope in project that shows severity for planning, design and execution of projects [8].

Changes in technology rapidly influence the workforce in the form of cost and material. So a rapid response is required for technology that is going to be changed with the course of time.

The product availability, features, aesthetics and costing is changed with changed technology and transformation in the marketplace occurs. Also a change in technology demands skilled and flexible workforce in specific areas.

Quality achievement in today's world is a huge task for every organization for their future growth and revenue generation. It is also a fact that in software industry most of the clients are not awarding their contracts to the service providers due to bad quality experiences with whom they have already worked. In United States questions still arises on management soft wares just because of quality. So for the quality of a software, modification with ease of implementation is essential [9].

Technological culture

Technological culture within the organization plays an effective role in conducting the business processes. Different factors are involved in technological culture that may include effective communication within teams in organization or outside the organization with the client. Adaptation of innovative solutions is also important while catering the technological culture and its impact on technical SOPs. Management support in positive changes also plays a role in technological culture.

Two way communications within the teams and with the client is very important. For strategic depth and better financial results, interaction between employer and service provider is very much essential. Communication effectiveness plays a critical role for betterment of functional and technical quality of service [10].

Innovative processes also influence the technological culture in organizations. To become pioneer of products in market innovative culture is mandatory in organizations. In software development organizations innovative culture must be setup by the higher management because when the higher management is open to accept change and adopt innovative practices then there remain very less resistance from associates and supervisors.

According to Stewart and Mohamed [11], market is controlled by those organizations that have embraced change in the form of technology and innovation.

Supportive changes within the organization should be integrated by supervisors in the form of structure, behavior changes. Strategic

adaptations are required for HRM to implement changes for effective organizations and match resources for requirements in future [12].

Positive changes should be welcome in the organizations that are conducting projects but there is a big question mark that how to tackle change. Changes can be differentiated in external, internal and technical. For change incorporation the word "NO" is a big hurdle and that shows resistance from any tier of organization. For requirement changes resistance can be shown by higher management, first tier supervisors or lower management working on hard copies. For a change, resistance should be managed. Resistance does not mean that it is shown to the new technology that is going to be implemented within the organization but it is the culture that is resisting the implementation of technology [13].

Changes in technical SOPs (Standard Operative Procedures)

Standard operative procedure (SOPs) is set of activities that are performed by individuals to accomplish a task safely and accurately. Requirements for operations and productions are achieved by following SOPs. Requirement changes also influences the standard operations of ongoing projects in the form of scope change and ultimately results in cost and schedule overrun. Contingency plan should already be established by organizations that are playing role of contractors or service provider for mitigating the change effects.

In software projects different processes are encompassed to perform different tasks. For this purpose a detailed document is written to accomplish step by step processes. From inception to the closure of projects this document is a guideline for each tier. As it is evident from past experience that change is inevitable for most of the projects so the organizations conducting projects must be able to face the requirement changes in an adaptive way and careful manners. Roles and responsibilities of work force changes according to need of business requirement changes. Integration change philosophy emerges on basis of requirement changes and needs [14].

Another aspect of changes in technical SOPs is to maintain quality of ongoing processes of projects. Managing changes in requirement is in account for more time and cost for any projects in today's turbulent enterprise environment. Efficient response of team towards requirement change will reduce the cost and time and increase the quality of work [15]. From this point of view it is analyzed in research that most critical part for sustainability of any business and to get loyalty of client is quality of projects or products.

According to Lindley [16], the implementation of new software product causes budget overrun and extra trainings. It distorts the overall capital budget procedure and decision making procedure by raising the capital of projects.

Projects schedules are highly affected by changing the established operating procedures. Projects are planned under strict ETA (Estimated Time Allocation) systems. Any sort of change whether it is a scope change or resource change severely affects the schedules of overall projects. For controlling the schedule overrun organizations have to establish change control board. As the schedules are affected mostly by change requests, so a mechanism should be defined to monitor the overall process of change and to avoid schedules overrun. According to Belk and Steels [17], scheduling systems are useful for balancing costs of stock holding, planning and customer service.

Change begins with a vision. Visionary people always foresee changes in the form of innovation. Despite of external (economic, technological, social or political) or internal factors (policy, procedures or indicators), the vision will always clarify the direction and need for change [18]. With the effect of procedural changes the internal factors are rarely affected but these changes put their influence over the internal factors of projects.

Literature gaps

This area of research is of significant importance but unfortunately this field is not given that attention which it deserves that is evident from the scarcity of relevant material in literature. Through this research researcher is going to address those factors which are not discussed previously or if discussed by some researcher is not brought to some workable recommendations.

Description of the model

In the literature review researcher has elaborated different concepts regarding the changes in technical SOPs. Figure 1 below presents a conceptual framework which will be further refined in literature review process, explains the relation of the constructs (independent variables): Political, Economic, Social, Technological and requirement changes of software industry. Impacts of these above mentioned Independent variables on changes in technical SOP's. A mediating variable Technology culture is also used in theoretical frame work for its positive mediating impact between the relationship of requirement changes of software industry and changes in technical SOP's.

Evidences from literature

Following requirements change attributes contribute most to the problem: total number of requirements change, number of documents affected, sources of requirements change (internal and external), and change types (addition, deletion, and, modification), are statistically significant contributors to the change effort [19].

Critical analysis

Changes in requirements of a project is an inevitable factor but it leads to generation of a number of challenging situations for concerned people particularly for the management and the workers engaged in the particular project. A variety of factors are found to be playing their roles in this context, out of which time and frequency of changes are the most influencing ones.

Hypotheses

On the basis of theoretical model following hypotheses:

H1: Impact of requirement changes in software industry on changes in technical SOPs.

H2: Mediating role of technology culture between requirement changes and changes in technical SOPs.

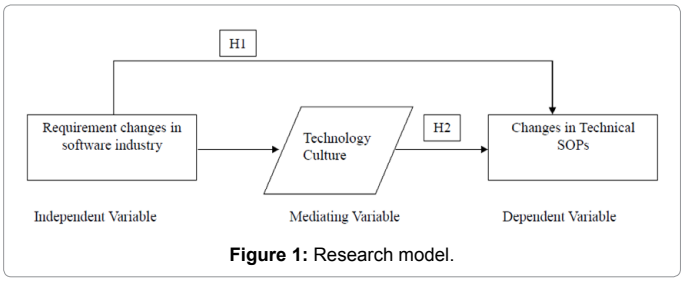

Figure 1: Research model.

In the light of analysis the above mentioned hypotheses were tested and result was made. All the analysis and results were developed and described in next chapters.

Methodology

Research is finding or investigation done in a systematic manner in order to discover something new or interpret some old findings in a better presentable way. The way research is carried out depends on the aim it is targeted towards i-e some new innovative idea is going to be developed or the expansion of some old work done in any specific field is going to be done. A systematic approach is fulfilled only if some methodological ways to perform the research are adopted. So in order to extract some authenticate and legit results from our data we have followed and discussed in this paper different research methodologies. We have discussed primary and secondary in this paper. We have also explained the different research approaches that we have followed in our research. Data has been analyzed in both qualitative and quantitative way and then the results have been described with their merits and demerits. The research instruments used in this research have also been explained in detail in this paper. In the end some ethical rules are explained that were governed by the institute and have been keenly observed by the researcher in order to present the authentic and factual results.

Rationale of study

In this world of globalization the competition in every field in growing exponentially and everyone out there is striving hard to make its position on top. Survival for the fittest theory holds very much true in this age of competition. As a service provider if you intend to compete your competitors in the market you need to deliver products to the customers that are very much valuable and profit gaining for them. Delivering of quality work to the customer on time involves many factors to taken care of. In ICT sector accomplishment of project on or before deadline in very much important. Sometimes the phenomena of "first mover advantage" holds very much important for the customer you are serving so in that case you need to deliver him the quality product right on time. In the light of all above discussion the role of requirement changes in any project is very much vital. Sometimes it can affect the overall project very adversely. So this study is intended to study and analyze the role of requirement changes in accomplishment of overall outcome of any project.

Research process

Research process consists of number of steps that every research undergoes in order to present the concrete and authentic results. This process is iterative in which the reverse path can also be taken if needed which is unlike the waterfall model in which going reverse is not an option. Different steps like identification of problem, localization, assessment, analysis, development and expansion of ideas. The following diagram will make this process better understandable.

Instrument development

The data is collected in any research in such a way that it can help in better conclusion and identification of the facts. The authentic and concrete the data, the more reliable are the results. So in order to achieve the better and concrete results the researcher designed a survey form that was very much related, concrete and compact. In start of that survey form personal information like name etc. was taken from the audience but this was kept optional so that no one is forced to disclose his/her identification. This has been observed that many people avoid disclosing their personal information and when forced to do so they decide not to take part in survey, so giving personal information was kept optional. Further the survey form was distributed among people from different areas of ICT industry that included software engineers, quality assurance professionals, project managers, project coordinators, people from telecom industry etc. but no one was forced to fill out the survey form. The reason for this is that people on being forced on some task might do that in hurry or not seriously which can badly affect the results of research. The survey form consisted on questions that covered all aspects of affects that occur when there are changes made in requirements of any project. Getting the survey form filled from the people who actually experience these affects led researcher to make better and concrete conclusion to the phenomena.

Pilot survey

The questions there in the survey form were reviewed by supervisor of research and experts from ICT industry. After discussion on the questions included, there were some changes made in the survey form. Some questions were also added based on the suggestions from domain experts. After alteration of the survey form, it was finalized and was distributed among the professionals in ICT sector. Such type of review, verification and modification made in the document is referred as pilot survey.

Research parameters

Population: Since the effect of requirement changes in any project is something that is experienced by many people in ICT industry. So in order to conclude result on actual and real data the survey form was prepared keeping in mind all the factors. The form was distributed among people from ICT sector. Those people included software engineers, quality assurance professionals, people from telecom industry etc. The forms was distributed among large number of people but since no one was really forced to fill out that form so not a very big amount of filled forms were returned for data analysis. The shortage of time also limited this number as much more and better amount of filled out forms could have been obtained if a suitable time was available. Since this factor of requirement changes very common in ICT industry and large number people experience it quite often so if more time was available then much more forms could have gotten filled out for real time and accurate analysis of data.

Sample: The population can be taken as the universe of data and a sample from that universe is taken out for analysis of phenomena. The survey form was distributed among 280 respondents. After eliminating discrepancies from collected data record of 256 respondents, it was tabulated for data analysis. There were 18 questions in the form that were designed in order to cover all the aspects that get affected by the changes in requirement changes made to any project's requirements. As per availability of the respondents researcher has used convenience sampling for this research work.

Ethical issues

Following ethical issues were following by the researcher in this research.

a) None of the respondent was forced to become the part of survey. It was all done on volunteerism basis

b) Rules regarding the misuse and leakage of data imposed by the institute were strictly followed in this research

c) All respondents were briefed about the aim of the research and questionnaire before the submission

d) All the information collected in the survey was taken care of and no part of it was leaked out or misused

e) Plagiarism rules of the institute were strictly followed in this research

Data Analysis and Interpretation of Findings

In research data in the form of facts and figures is rediscovered with some new and innovative changes by keeping their originality. Research is conducted to verify the modification occurs in data from current state to the future state. Basic aim of research is to refine data again and again. This particular research is designed to find methods, tools and techniques for finding impact of requirement changes on ongoing technical SOPs in software industry. Following variables are mainly discussed in this research for data analysis.

- Requirement changes in software industry (Independent variable)
- Technology Culture (Mediating Variable)
- Changes in technical SOPs

For this particular research different ICT sectors were focused like telecom and software industry. Mainly focus was on software industry for data collection. A questionnaire that consists of 18 questions was first checked for expert content validity by experts from academia. Some amendments were suggested by experts and those changes became part of questionnaire. Alongside this practitioner content validity was also performed by experts from software industry. After performing changes and refining of instrument that was in the form of questionnaire, it was distributed among 280 respondents. After eliminating discrepancies from collected data record of 256 respondents, it was tabulated for data analysis.

A likert scale was used in the beginning of questionnaire to develop an easy way for respondents. Numbering was given from 1 to 5 to likert scale and 5 options were given for filling data to respondents. Likert scale with its representation is given below in Table 1.

Analysis of responses

For data analysis portion SPSS 20 was used by researcher. Cranach's alpha was used for internal consistency of instrument used. Limit for internal consistency is from 0.7-0.9. All the results were between 0.7 and 0.9 so the data was reliable for further testing.

For normality of data researcher has used Kolmogorov-Smirnov test which shows that data that data is significant.

For factor analysis Bartlett's Test of Sphericity was conducted and the KMO values were determined. The value of KMO should be >0.5 and the results show that KMO value for Technology culture was 0.832, Requirement changes 0.89 and Changes in Technical SOPs was 0.846

Scale	Classification
1	Very Little Extent
2	Little Extent
3	Uncertain
4	Greater Extent
5	Much Greater Extent

Table 1: Likert scale representation.

Reliability Statistics (N=256)	Cronbach's α	No of Items
Technology Culture	0.855	5
Requirement Changes	0.866	7
Changes in Technical SOP's	0.848	6

Table 2: Reliability statistics.

respectively. The greater KMO values shown in Table 2 were enough for sample to define the correlation. Correlation matrix is not an identity matrix (Table 2).

In order to check the mediation impact of independent variable on dependent variable four steps of Barron and Kenny method were used. The primary purpose of these steps is to identify the significant relationship, if there is no relationship then the mediating impact is no more possible [20].

In first step, REQCHN significantly predict SOPC (Changes in technical SOPs), b=0.732, t=16.231, p<0.000. REQCHN also explained a significant part of variance in SOPC, R2=0.509, F(1,254)=263.457, p<0.000. In second step, researcher found that REQCHN significantly predict TECHCL, b=0.835, t=21.588, p<.000. REQCHN also explained a significant part of variance in TECHCL, R2=0.646, F(1,254)=466.056, p<0.000. In third step, researcher found that TECHCL significantly predict SOPC, b=0.677, t=14.977, p<.000. TECHCL also explained a significant part of variance in SOPC, R2=0.467, F(1,254)=224.313, p<0.000. Finally, In fourth step, researcher found that REQCHN and TECHCL significantly predict SOPC, b=0.685, t=14.977, p<0.000. REQCHN also explained a significant part of variance in TECHCL, R2=0.544, F(1,254)=150.86, p<0.000. An improvement in adjusted R2 from 0.467 to 0.54 which shows that partial mediation exists between variables. Hence it approves the hypothesis that TECHCL (technology culture) positively mediates REQCHN (Requirement changes in software industry) and SOPC (Change in technical SOPs) (Tables 3 and 4).

Conclusion

Success of any enterprise that is conducting projects is based on project selection, if it is not selected on proper basis with rules and regulations then it can lead to ultimate failure [21,22]. After selection of best project among all, the most necessary thing is to sit with client and brain storm in regard of the ongoing project. Requirement gathering is the most critical and worthy process in the preliminary stages of project. Clear requirements can lead a project to ultimate success and vague and unclear requirements leads to disaster. In this particular research focus was mainly on requirement changes and its impact on technical SOPs. It is a fact that in today's world where changes occur in no time, it should be taken in consideration that what other things are affected with requirement changes. In the mind of customer any change request is used for betterment of the project. Any requirement change is either for betterment of project or it is a scope change. With these changes mostly the triple constraint of project i.e. Scope, time and cost are modified. To overcome these changes we have to allocate more resources. The process of requirement changes cannot be completely avoided in today's era of globalization where the technology is changing very rapidly. The changes in requirements should be addressed very carefully. All the changes should be very carefully analyzed, their impact on overall time, cost and scope should be estimated carefully and then the changes passed should be subjected to implementation phase. Dependent and Independent variables should be kept in mind while working in an industry where requirement changes are a part daily process. There lies another type of variable in between dependent and dependent that should be taken care of is mediating variables.

Descriptive Statistics (N=256): Item of each variable	Minimum statistics	Maximum statistics	Mean statistics	Standard deviation statistics	Skew ness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
TECHCL 1	1	5	40.7	0.825	-1.321	0.152	3.072	0.303
TECHCL 2	1	5	3.98	0.838	-1.093	0.152	2.037	0.303
TECHCL 3	2	5	3.88	0.797	-0.334	0.152	-0.316	0.303
TECHCL 4	1	5	40.7	0.830	-1.011	0.152	1.525	0.303
TECHCL 5	1	5	4.01	0.819	-1.015	0.152	1.872	0.303
REQCHN 1	1	5	3.99	0.892	-1.046	0.152	1.388	0.303
REQCHN 2	1	5	4.02	0.784	-1.312	0.152	3.339	0.303
REQCHN 3	1	5	4.08	0.850	-1.345	0.152	2.986	0.303
REQCHN 4	1	5	3.76	0.910	-0.478	0.152	-0.064	0.303
REQCHN 5	1	5	3.95	0.793	-0.718	0.152	0.703	0.303
REQCHN 6	1	5	4.00	0.802	-0.920	0.152	1.352	0.303
REQCHN 7	1	5	3.95	0.877	-0.813	0.152	0.687	0.303
SOPC 1	1	5	3.68	0.916	-0.576	0.152	0.210	0.303
SOPC 2	1	5	3.83	0.863	-0.887	0.152	1.196	0.303
SOPC 3	1	5	3.97	0.766	-0.737	0.152	1.233	0.303
SOPC 4	1	5	3.92	0.857	-1.123	0.152	2.166	0.303
SOPC 5	1	5	3.90	0.862	-0.766	0.152	0.531	0.303
SOPC 6	1	5	3.80	0.870	-0.828	0.152	1.001	0.303

Table 3: Descriptive statistics.

	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
TECHCL1	0.308	0.00	0.772	0.00
TECHCL2	0.31	0.00	0.803	0.00
TECHCL3	0.269	0.00	0.851	0.00
TECHCL4	0.285	0.00	0.809	0.00
TECHCL5	0.299	0.00	0.808	0.00
REQCHN1	0.294	0.00	0.817	0.00
REQCHN2	0.338	0.00	0.757	0.00
REQCHN3	0.299	0.00	0.774	0.00
REQCHN4	0.25	0.00	0.875	0.00
REQCHN5	0.307	0.00	0.825	0.00
REQCHN6	0.313	0.00	0.808	0.00
REQCHN7	0.281	0.00	0.839	0.00
SOPC1	0.267	0.00	0.872	0.00
SOPC2	0.308	0.00	0.832	0.00
SOPC3	0.301	0.00	0.82	0.00
SOPC4	0.312	0.00	0.803	0.00
SOPC5	0.301	0.00	0.837	0.00
SOPC6	0.312	0.00	0.84	0.00

Tests of Normality (N=256)

Table 4: Tests of normality.

The data collected from real time survey in the ICT industry helped in clearly explaining the effects of requirement changes in any project. Since this data was collected from the people how personally experience this phenomena on daily basis, the results gave clear and actual insight to this fact. If more time and resources were available this research could have been done on much larger scale to analyze and conclude the effects of requirement changes.

Recommendations

On the basis of questionnaire results and previous literature, a knowledge base has been extracted which suggests that requirement changes and mediating factor technology culture has a positive effect on changes in technical SOPs. For improvement in standard operation procedures of projects in ICT sector some recommendations are given by researcher.

Based on the knowledge gained through questionnaire survey and review of literature, researcher has become able to put forward some workable recommendations which are easy to follow and quite an obvious way to bring in improvements in the performance of ICT industry of Pakistan in terms of project selection.

- Requirement gathering is a vital process in the initial phase of project. Careful and precise requirement collection is essential for the whole life of project
- As change is a part of almost every project, proper change control processes should be implemented in organizations
- Change should be in change request form with proper format
- Change control board should be present in every project-based organization which must contain a team of expert both from service providers and customer
- Decisions for acceptance or rejection of a change request should be made in regard of opinion given by change control board
- Avoid scope creep and develop practice of change logs

Limitations and Future Prospects of Research

This particular research was conducted to accommodate gaps that were found in literature that was studied for field under consideration. This particular research was conducted on practical implication of requirement changes in ICT sector. Mainly focus was on scope creep that is mainly termed as unapproved changes in software industry in ICT sector. Researcher addressed that to mitigate the adverse effect of requirement change there should be a proper change control board in specified field.

As this was an academic research so there was some challenges and limitations for researcher in the form cost and time, so the survey was conducted at small scale. This was the main reason for small sample size.

Requirement changes are eminent in most of ICT organizations that are conducting projects. Adverse results in the form of project failure can be obtained if requirement changes are not properly addressed.

This particular research should be conducted at some larger plate form, with a large number of resources and involvement of more ICT organizations. The result of large survey will result in less failure and greater success in ICT projects.

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