www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 5 Issue 11 Nov. 2016, Page No. 19244-19248

Users as knowledge co-producers in the Information Systems Development project

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Abstract— **Information Systems Development is a set of techniques aimed to provide solution to any business-problem statement through a chain of processes and a set of resources like human, capital, etc. The ISD process is under the ownership of a number of stakeholders. One very crucial stakeholder is the end-user. The role of user in the whole phenomenon has always been a matter of controversy within and between the organization and its research and development team. Though the belief is not grounded but it has been observed widespread in the information systems discipline that user participation is necessary for successful systems development. Hence, accepting the general idea of user being a knowledge co-producer in ISD, we shift our research focus towards distinguishing between the terminologies defining the user as a knowledge co-producer in this domain. In this paper, we aim for a survey to determine the relationships, activities, processes and effects of user involvement, user participation and user attitude during IS implementation. We aim to learn the behavior of users based on the project goals. We aim to conclude if users turn to be a knowledgeable asset resulting in a successful development of information system project or lead to a failure.**

Keywords— *Knowledge, co-producers, user involvement, user-participation, information system Development (ISD), Project performance, Requirement determination, User–IS relationship, User review*

1.Introduction

The Management Information System department in an organization has been considered as support functionality. And also, information system development (ISD) work is considered as a crucial part to support the ongoing business operations. A firm's overall growth and development certainly remains into the hands of the Information System department. Information Sytem Development can be understood as a process in which developers takes the requirements from the user and transform them into a design which is then implemented. Now the question driving all the attention is what determines the success of the ISD process. Why do certain projects fail inspite of a strong technical development team? Why are some projects cancelled or do not get completed in the predefined budgets. Many researchers have found out that the lack of user involvement and engagement is one of the major causes in the ultimate failure of the Information System Development. Denying users the opportunity of engagement and review in the project leads to unnecessary requirement of extra time and cost for the remedial work. These are the cases where the final systems either do not meet the user requirements or fail to stand on the project goals.Hence, researches bring out the concept that including users in the process of development of a system generates a positive impact on the process by increasing productivity and moreover improving users' attitude towards the system.

A perspective has emerged, called as service-dominant logic, which basically suggests that customers can act as value co-producers. Co-production is an active, creative and social process which is initiated by the firm and is based on collaboration between producers and users, and is used to generate value for customers ISD which can be viewed as a value co-production process in which users and developers work closely to determine the system requirements and implement the resulting system to support organizations' daily operation. If we know that the users operate in the developed system in their daily activities then these users are considered as the final customers of the ISD service. ISD is a knowledge intensive process, and it is part of the developed system which can be viewed as a new knowledge which combines developers' IT knowledge and business users' domain knowledge. The value created through the development process is that of co-production, which results in a system which can be viewed as new knowledge co-produced by users and developers. Users can be considered as a crucial part by encouraging them to engage themselves in the development process which will lead to enhancement in the value of the developed system by avoiding an outcome that falls short of actual need. By avoiding this danger, the additional costs and time required to repair inappropriate design in the early stages of development work can also be avoided. Hence, this indicates the importance of users, who should not be

ignored and should be involved in the activities when pursuing high project performance.

The literature namely called as ISD literature offers us a huge amount of useful and interesting user participation research on the traditional approach to systems development, yet it is clear that little is known about the influence of alternative approaches that have emerged from different development contexts. Therefore we will see how well it works in today's ISD context. The ISD research offers us the information that one reason for failure in ISD implementation is the lack of communication between users and developers. Therefore, we would expect systematic variations across contexts in user participation processes, activities, communications, and the relationships of participants.

2. Literature Review

2.1 User Involvement

Over the past 30 years or so, the involvement of user in the Information System Development has been considered as a crucial factor in the evaluation of the success of any related initiative. The kind and extent of contribution a user can provide as a knowledge co-producer is typical of the methodology implied in the Information System Development. Our sole motive towards this research study is to reach to a conclusion regarding the relationship between user role and the success of Information System Development. The research question that guided the entire paper is: What is the relationship between the user involvement in system development and the system success? To get to the answer, let us first study the working of Information System Development and behavior of user into it.

ISD can be viewed as a problem-solving process in which developers apply their knowledge to bring optimal solutions to the problems raised by users. This process involves intensive knowledge. In general, in order to carry out information system development, members of the team must possess sufficient knowledge-based resources, such as project management knowledge, system analysis skills, programming knowledge, database administration knowledge, etc. In addition to system development knowledge, business knowledge is one of the critical resources for successful system development. However, the presence of various types of knowledge in the team does not guarantee the final performance. To pursue common goals in projects different stakeholders need to transform their individual-level knowledge into collective knowledge. Therefore, knowledge possessed by users and developers need to be accessed, leveraged, shared, and maintained for the benefit of the project. The effectiveness and success of problem solving or uncertainties countering relies on how well users and developers integrate these two types of knowledge into one powerful resource.

Knowing that the effectiveness of process lies in the integration and collaborative efforts of the developer and user, we are now concerned to define the involvement of user in this process. User participation was originally viewed as a user and developer "cooperatively involved to the extent that the activities of each facilitate the attainment of the ends of the others". This definition implies that users should be viewed as co-producers who work with developers harmoniously so as to carry out the final system. We define user involvement as "The extent to which users or their representatives carry out assignments and perform various activities and behaviors during information system development and is conceptualized along four dimensions, i.e., users' hands-on performance of activities, responsibility, relations with IS, and communication with IS staff and senior management The effect of this participation varies for different IS development contexts." User involvement undoubtedly covers many advantages in development process. It provides relevant knowledge for organizations and reduces unnecessary needs. It decreases resistances, resolves conflicts and adds towards the reliability and acceptance of the system.

2.2 Service-Dominant Logic

Since the time of the industrial revolution, product has been focused on the traditional model to fit the manufacturing oriented economy. This model seeks equilibrium and maximization of profit and utility. This traditional view is well known as goods-dominant (GD) logic. In GD logic, value is created by the firm and distributed in the market. During the last century, the concern has drifted towards customer satisfaction. This new perspective led the whole environment towards a new environment of economy-service economy. Different from goods-dominant logic, service-dominant logic emphasizes the necessity of collaboration users. It highlights the importance for service provider to coordinate with user, involving them into system design and development. The recently emergent service-dominant logic concept also asserts that the effectiveness of value creation relies on the extent to which those operant resources (such as knowledge or competence) possessed by customers can be incorporated into the service design and development process. The primary concept of service-dominant logic includes: (1) the conceptualization of service as a process, rather than a unit of output; (2) a focus on dynamic resources, such as knowledge and skills, rather than static resources, such as natural resources; and (3) an understanding of value as a collaborative process between providers and customers, rather than what producers create and subsequently deliver to customers. By applying service-oriented concept in ISD projects, users can be treated as co-producers and should not be excluded from the process.

2.3 User Co-production

User-IS co-production is different from user involvement. User-IS co-production is more active and has altruistic behavior. Bettencourt has proposed eight categories about co-production, such as open communication, shared problem solving, involvement in

project governance, personal dedication, tolerance, advocacy and accommodation. Open communication refers to the extent to which developer and user share information about the project with each other. Lack of communication can lead to failure. Shared problem solving implies that any problem incurred should be jointly solved by the developer and user. Involvement in project governance says that user should actively take part in monitoring the progress of the project towards predefined goals. Personal dedication reflects the sense of dedication and responsibility towards the success of the project. Tolerance instructs to be patient and calm in handling problems or inconveniences encountered on the way to the final system. Advocacy means the need to act as a representative and do the marketing of the developed system among outsiders and other end-users. Lastly, accommodation refers to the extent to which users show willingness to accommodate the desires, approach and expert judgement of the developers.

Along with the background study of the concepts of ISD and service-dominant logic, to deduce the answer to our question, we performed a study of several papers (related to the scope of the paper). The primary search of the relevant papers in this domain was made on four major search terms namely, user, involvement, software development and information systems. The primary search for the papers were done on a range of online databases; ACM Digital Library, IEEE xplore, Science Direct, Google Scholar, Citeseerx, Springerlink, and MIS Quarterly. The results from the primary search strategy were initially screened on abstracts only to filter out totally irrelevant papers that were retrieved due to poor execution of search string by online search engines specially Citeseerx and Science Direct. After initial screening the papers on abstracts only, we excluded the studies that were not from the domain of IT/CS/SE/IS and were not following empirical method. Duplicates were discarded prior to applying the selection filter. During quality assessment phase we came across some extremely low quality and plagiarized papers (though in both cases they were relevant), we excluded them. In synthesis we were also interested to divide the results against two criteria; the year of publication (divided in three decades) and research methodology utilized by the study in producing the results. The reason for analyzing year of the publication was to see the overall trends in three decades to compare with the previous reviews, and the reason for methodology was to evaluate the differences of results based on inquiry design as it was said in to be giving rise to conflicting results and making meta-analysis difficult.

3. Methodology

The research model in shown in Fig.1. User is engaged in two ISD stages:

3.1 Design

Knowledge is one of the crucial resources in ISD process. Any negligence in knowledge gathering can lead to severe risks. The required knowledge cannot alone guarantee the success of project. It needs to be integrated with the business knowledge. The system design work can be viewed as a process in which users express the business needs and system analysts transform those needs into system design on the basis of their information system design knowledge. It can also be viewed as a process of integrating the business knowledge of these two parties. Both parties should respect each other's opinion and participate in each other's key process. This mutual trust, respect and togetherness are reflected by User-IS relationship in the model shown below.

3.2 Development

Assuring the requirements determined in design state can be actually carried out, the next task is the conversion of all those into a real time working model within a predefined budget and schedule. Once the design work has been completed, coding work is then assigned to individual programmers. Correct functions can be developed if system analysts are able to transform user requirements into system design. In contrast, performance is impaired if system design cannot reflect actual users' needs, making remedial work unavoidable to correct the inadequate designs. This, in general, results in schedule delay and extra costs. Empirical studies also indicated that failure to integrate existing knowledge is one of the major barriers to producing high project performance. Many projects cannot adhere to predefined schedules or budgets because development teams fail to identify potential problems. These include failure to identify actual requirements in the early stages. In fact, many systems are first presented to end users or senior managers during the testing or even implementation stages. This results in the identification of case flaws and inappropriate functions in the latter stages of the project. The remedial work costs for flaws found in these latter stages are much higher (40 to 100 times) than they would be if identified in the early stages. Extra time and costs are then needed to repair the inappropriate design. Project performance is also impaired when the project team fails to discover flaws and defects in the early stage. In addition, users will refuse to use the system if it fails to function as required. One possible approach to avoid the above problem is to utilize users in the development process to ensure the developed product satisfies users' needs. Users should review the work completed by developers periodically so as to reduce unnecessary costs caused by inappropriate design. Furthermore, requirements may alter with the emergence of new technology and changes to the external environment. Users should also provide the most current information in order to counter uncertainties resulting from external environments. Based on the above discussion, we predict that users engaged in the development process to review periodically the work done by developers can lessen the negative impact of inappropriate design. Moreover, their engagement provides greater assurance that the project will be accomplished on time and within budget.

DOI: 10.18535/ijecs/v5i11.94

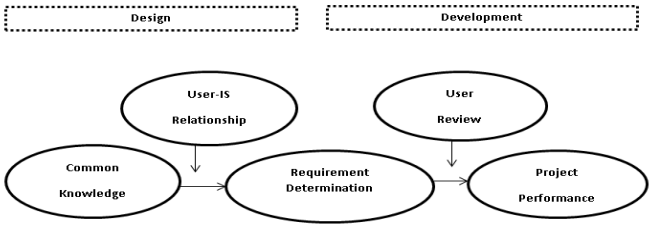

Fig. 1

Now from the study of various papers related to the topic, we can summarize the relationship between users and Information System through the following table:

Approach	Technique	Backlogs
ETHICS (Effective Technical and Human Implementation of Computer-based Systems	ETHICS consists of the following systematic steps: 1. Diagnosing business and social needs and problems. 2. Setting efficiency and social objectives. 3. Developing a number of alternative solutions 4. Choosing the most satisfying solution 5. Designing this solution in detail. 6. Implementing the new system. 7. Evaluating the results.	Time consuming
Joint Application Design (JAD)	1.Identify project objectives and limitations 2.Identify critical success factors 3.Define project deliverables. 4.Define the schedule of workshop activities 5.Select the participants 6.Prepare the workshop material 7.Organize workshop activities and exercises 8.Prepare, inform, educate the workshop participants 9.Coordinate workshop logistics	The facilitator has an obligation to ensure all participants
RAD (Rapid Application Development)	1.Business modeling 2.Data modeling 3.Process modeling 4.Application generation 5.Testing and turnover	1.The risk of a new approach 2.Less control 3.Poor design 4.Very large systems

Relationship of User Involvement to System Success:

Fig. 2

Decade	Results	Research Method	Total
1980	+ + -	Survey(1) Survey(10) Survey(4)	3
1990	+ + - ?	Survey(2) Survey(3) Experiment(8) Case Study(9)	4
2000	+ + +	Case Study(5) Survey(6) Case Study(11)	4

DOI: 10.18535/ijecs/v5i11.94

	?	Case Study(7)		
Total(7)		+	7(63.6%)	
		-	2(18%)	
		?	2(18%)	

Fig. 3

+ = Positive

- = Negative

? =Uncertain

4. Discussion

By careful observation of Fig. 2, we infer that the involvement of user has a positive impact in the process of Information Systems Development in software engineering domain. We observe that 71% of the papers studied reported a positive user involvement in the successful development of Information Systems. If we take a look on the insightful findings of the study for particular decades, we observe that:

1. In the year 1980-89, 66.67% of the findings showed a positive user involvement while there was 33% of negative impact reported with no uncertainty.
2. In the year 1990-99, 50% of the findings showed a positive user involvement while there was 25% of negative and uncertain impact each.
3. In the year 2000-09, 66.67% of the findings showed a positive user involvement while there was 33% of uncertain user impact reported with no negativity.

5. Future Scope

The following steps can be taken in the future to provide more reliable solution:

1. Study of more number of related research papers.
2. Reducing the span of number of years taken into consideration
3. Empirical investigation of the users at various levels during the entire information system development lifecycle.

6. Conclusion

Our Review confirms the positive effects of user involvement on system success. But the deeper analysis of the results shows that user involvement is a multifaceted phenomenon which cannot be easily evaluated by simple binary relationship with system success. It is a double edged sword. If user involvement is not handled carefully right from the phase of requirement gathering, it can lead to serious problems and ultimately, the project would fail. Our review has revealed multiple factors that characterize user involvement and its contribution to the system success which will be presented with detailed analysis in our future work. In the end, we conclude from the above studies that user participation can lower the chances of system failure.

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