

An exploratory analysis on challenges prevailing in small and medium IT firms

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Abstract. There is lot of challenges being faced by IT Firms. Be it the pressure on companies to deliver reliable software's with lesser lead times, pressure to perform at par with market competitors, constant push to deliver quality software; there are several such challenges being faced by these firms. In this research paper, we want to focus our attention to small IT Firms and to understand their challenges by conducting a survey with the help of a structured questionnaire. The questionnaire is designed through the past problems highlighted in literature and a validated through responses from industry practitioners. The opinions are recorded and the relationship between the variables are analysed to give a better understanding of the present challenges in small IT Firms. The work presented in this paper is the first phase towards the development of a framework targeted towards SME IT firms for whom increased lead time is a primary bottleneck. In order to solve a problem, it is essential to understand it in depth and to analyse if there is any gap between the perceived bottles presented in the literature, and the actual problems faced in the industry. Hence, in order to bridge that gap, we have made an effort to structure out the questionnaire based on our findings and have tried to determine if the same can be validated through the responses acquired from the industry in practice.

1. Introduction

MSMEs (Micro and Small and Medium Enterprises) are the vital part of the economy of any developing nation. The primary characteristic of such organizations is their dynamicity and volatility, [10] [15] [16] due to the very environment which they are exposed to. In a country like ours, they contribute a good share in the economy and hence it becomes pivotal for the researchers and practitioners to understand the way they function and suggest measures which can increase their efficiency and productivity. This paper is focusing on software firms falling into this category and is an attempt to uncover the problems faced by them and determine the issues requiring immediate attention. The work essentially has 3 parts namely (i) identifying the problem (ii) addressing the issue and propose a framework for support (iii) determining the efficiency of the proposed framework. This paper targets the first step where in data was collected through structured interviews and questionnaire and primarily an attempt to determine the factors causing bottlenecks in the functionality of the MSME Software firms targeting four fundamental research questions.

The rest of the paper is organized as following. The next section presents related works. The subsequent two sections, presents the methodology and discusses the results and findings. The last section concludes the work presented in this paper.

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2. Existing work : A peek into the literature

Improving the software process, producing quality and error-free software, meeting project deadlines and improving efficiency of people and process are some of the aspects which has always held the attention of project managers and software solution architects. Literature is flooded with works in this area, each highlighting region-wise study, or study targeting a particular industrial segment.

In this paper, to form a baseline of the problems involved, we have tried to analyse those papers which talk about small IT firms-in order to understand their idea of the software process model and the bottlenecks involved. The search string was inspired by [4] and we also followed the same for the initial selection of papers. The string used was (challenges OR bottlenecks OR difficulties) AND (sme or small and medium enterprises) AND (SPI or software process improvement) AND (software waste [20] [13] [14]). The following sections talks about the insights gained from this process.

Mohammed Elsalam et al. [1] talks about the importance of the SMEs in the developing nations and tells about the problems faced in software process in 5 Sudanese companies. The major problem highlighted includes absence of awareness about SPI and its models.

Deepti Mishra [2] brings forth the fact due to limited resources and strict deadlines, the SMEs are unable to tackle the quality issue of software. The paper also draws a comparison between existing SPI methods like OWPL, PRISMS and the like.

Jose et al. [3] in their paper, talks about the significance of requirements engineering in small sized software firms with respect of Mexico focusing on the industrial practices in Sinaloa, Mexico. The data was collected through questionnaires and interviews and quantitative results were obtained for further insight into the matter. A similar study was conducted by [11] with respect to Malaysian firms.

Both [4] and [5] provides a review on the process improvement techniques adopted in SMEs and highlighted the challenges and difficulties faced by them which includes financial and human related constraints, duration of project, work overload and low focus on process.

[6] talks about the challenges of Iranian SMEs. Lack of innovation was factored out as the major bottleneck and the study uncovered problems like inadequate education, technological change, scanty market information etc. during exploitation of innovative opportunities.

Pino et al [7] published a work explaining the various SPI approaches followed by different organizations and the authors strongly believed that the success of any such approach depends on institutionalizing the process.

Lavallee et al [8] studies the impact SPI causes on developers and highlighted both the positive and negative impacts. Some of the positive ones being better documentation and increased team spirit. The negatives ones being an increased overhead to the existing workload.

Unterkalmsteiner [9] performed a pre and post comparison for different SPI measures.

Melanie [12] factored out technological change and cost as the primary challenge faced by SMEs today followed by absence of skills, and insufficient back up, while [13] projects misconception and lack of resources as primary bottlenecks

It is clearly evident from the above that strong empirical evidences supporting the causes of the problems are missing in most of the papers. Also, clarity of the methodology being followed in arriving or moving towards a particular direction is also lacking. Also problems pertaining to large IT organizations cannot be generalized to small IT firms because of their inherent setup and functioning mode and the literature lacks work substantiating many such studies. Hence, keeping this entire mind, we made an attempt to address the former issue by trying to understand the problem from the perspective of the people actually involved in the industry (alongside the data gathered from literature) and so that the results obtained can be used towards finding an optimal solution for the decreasing the lead times of MSMEs.

3. Problem Statement

In a developing country, like ours, MSMEs and SMEs performance factors can contribute a great deal in shaping a country's economy. Focusing the attention to IT firms falling in this category, it is always observed that increased lead times, inability to deliver quality software and budget crisis are few of the myriad problems faced by them. Keeping this in mind, in this paper, we have tried to analyse which factors lead to addition of non-value added activities(also known as waste activities) in a process and

thereby contribute in increasing the lead time of the software. Also to validate the findings, the work was extended as a questionnaire to gather the industry opinion to narrow down the factors which could be used in the next phase of the work i.e. determine the cause-effect of the identified factors

4. Methodology

In order to determine the factors causing challenges in the SME IT firms, a questionnaire survey was conducted across selected such firms in Bangalore city. The responses were recorded in order to identify the most pressing problem areas. Four major areas emerged as a result of literature study namely financial and human resource constraint [4], nature of projects undertaken, smaller teams working under high work pressure, and less thrust on process improvement. The questionnaire was structured to include these four areas and the responses of the same were recorded. Considering the process improvement aspect, one of the critical point is that, process can be improved only when its underlying activities are fine-tuned and the ones which are non-important can be either eliminated or tweaked upon so that it can add value to the existing process. Keeping this in mind, four research questions related to this i.e. “waste/non valued added (NVA) activities”[21] are explored in the present paper. Of the several categories of waste specified by [17][19][22] Lean principles, we have focused our attention to four, which includes i) work left halfway ii) over engineering iii) re-learning and iv) handoffs. The aim was to identify its impact on SMEs and to determine whether it impacts the smaller projects the same way as it does the larger ones.

4.1. Reliability Test

We have carried out test for validating the reliability of our questionnaire, Cronbach alpha test was used with the help of IBM SPSS Tool. The Internal Consistency of our questionnaire has been within acceptable limits based on the coefficient value of alpha 0.83. The number of questions examined was 49 Items. The sample size of 300 was considered for our study

Case Processing Summary			
		N	%
Cases	Valid	295	98.3
	Excluded	5	1.7
	Total	300	100.0

Reliability Statistics	
Cronbach's Alpha	N of Items
.83	49

5. Results and Discussion

Research question 1: To examine the impact of PWD (partially work done) on projects undertaken in MSME and SMEs.

H01: There is no effect of partially done work on project deadlines.

H11: Partially donework affects deadlines

Dependent Variable	Level				ANOVA	
	Awareness of lean	N	Mean	SD	F	Sig
Prioritizing a demand without sufficient knowledge	Yes	192	3.22	1.226	10.1001	0.00981
	No	103				
	Total	295				
	Yes	192	3.68	1.33	15.39	0.00843

Wait times associated with sub tasks involved	No	103				
	Total	295				
Technical complexity	Yes	192	3.83	0.899	200	0.001
	No	103				
	Total	295				
Outlining improper and incorrect dependencies	Yes	192	3.36	1.43	14.009	0.00925
	No	103				
	Total	295				
Customer awareness	Yes	192	3.88	0.926	15.002	0.00967
	No	103				
	Total	295				
Defect repair rate	Yes	192	3.87	0.931	17.002	0.00967
	No	103				
	Total	295				
Required training for staff not available	Yes	192	3.01	1.251	13.019	0.0089
	No	103				
	Total	295				
Unclear interface specifications	Yes	192	3.67	0.944	17	0.001
	No	103				
	Total	295				
Unanticipated performance of CASE tools	Yes	192	2.62	1.219	13.001	0.00975
	No	103				
	Total	295				

Table 1: Anova Table for Hypothesis 1

The above table indicates the various dependent variables identified in the context of PWD keeping awareness of lean as an independent variable. Prioritizing a demand without sufficient knowledge, wait times associated with sub tasks involved, unclear interface specifications, unanticipated performance of CASE tools, technical complexity[18], outlining improper and incorrect dependencies, customer awareness and defect repair rate were the 9 reasons considered which could be responsible for work being left partially. At 95% Confidence Level and 5% Standard error rate, The Sig < 0.05, hence we reject the null hypothesis. From the responses, it is evident that Partially done work affects deadlines and hence the null hypothesis is rejected.

Research question 2: To examine the impact of over engineering/extra engineering

H02: There is no effect due to over-engineering on software projects.

H12: Over-engineering affects software projects.

Table 2: Anova Table for Hypothesis 2

Dependent Variable	Level				ANOVA	
		N	Mean	SD	F	Sig
Customers	Yes	192	3.88	0.92	12.002	0.00967

contribution	No	103		6		
	Total	295				
Lack of understanding of software vision	Yes	192	3.98	0.998	10.019	0.00889
	No	103				
	Total	295				
Functional expansion	Yes	192	4.16	0.69	9.016	0.019
	No	103				
	Total	295				
Extra features	Yes	192	3.2	1.168	10.021	0.00886
	No	103				
	Total	295				

The above table indicates the various dependent variables identified in the context of over-engineering keeping awareness of lean as a dependent variable. Frequency of customer's involvement, non-understanding of the software purpose, functional scope of the current use case and necessity of extra features were the 4 areas considered. From the responses, it is clear that each of the response displays a lower F score and a higher Sig value indicating close relationship between them and the variable being tested upon. At 95% Confidence Level and 5% Standard error rate, The Sig <0.05, hence we reject the null hypothesis. Over-engineering affects software projects is accepted.

Research question 3: To examine the impact of relearning on the software process.

H03: There is no effect of relearning on the software process.

H13: Re-learning effects software process.

Table3: Anova Table for Hypothesis3

Dependent Variable	Level				ANOVA	
	Awareness of lean	N	Mean	SD	F	Sig
Lack of understanding of the project	Yes	192	3.4	1.283	10.10	0.00985
	No	103				
	Total	295				
Lack of proper knowledge sharing within team	Yes	192	3.24	1.203	12.037	0.00848
	No	103				
	Total	295				
Lack of required documentation	Yes	192	3.31	1.073	13.017	0.00897
	No	103				
	Total	295				
Over optimistic and unrealistic schedules	Yes	192	3.71	0.883	12.010	0.0079
	No	103				
	Total	295				

The above table indicates the various dependent variables identified in the context of relearning keeping awareness of lean as a dependent variable. Missing out of essential documentation, over optimistic and unrealistic schedules, improper team communication, lack of understanding of the project were the 4 areas that displayed the maximum impact among the others considered. The responses displays a lower F score and a higher Sig value indicating close relationship between them and the variable being tested upon. Of the above mentioned aspects, the most significant impact is of lack of understanding of the project.

At 95% Confidence Level and 5% Standard error rate, The Sig < 0.05, hence we reject the null hypothesis. Re-learning effects software process is accepted.

Research question 4: To examine the impact of handoffs during the development life cycle on the process as a whole.

H04: There is no effect of handoffs on the software process.

H14: Handoffs effects software process

Table4:AnovaTableforHypothesis4

Dependent Variable	Level				ANOVA	
	Awareness of lean	N	Mean	SD	F	Sig
Missing information and miscommunication between team	Yes	192	3.84	1.032	14.001	0.01
	No	103				
	Total	295				
Lack of value understanding	Yes	192	3.78	0.917	13.001	0.012
	No	103				
	Total	295				
Experienced staff leaving the project before it is finished	Yes	192	2.54	1.244	11.05	0.02
	No	103				
	Total	295				
New technology dominance	Yes	192	3.21	1.139	19.019	0.03
	No	103				
	Total	295				
Market competitiveness	Yes	192	3.67	0.944	10.3	0.03
	No	103				
	Total	295				

The above table indicates the various dependent variables identified in the context of handoffs keeping awareness of lean as a dependent variable. Improper communication, misunderstanding the context, unavailability of key staff before project completion, technology turbulence, and market turbulence were the 5 areas considered. Inspecting the F score and Sig value indicates the highest association of market turbulence, improper communication and misunderstanding context with smooth transition during handoffs. At 95% Confidence Level and 5% Standard error rate, The Sig < 0.05, hence we reject the null hypothesis. Handoffs effects software process

6. Conclusion

Challenges drive the expansion and success. Without challenges, there is no urge to perform better and hence no striving for excellence. Corporations that adapt quickly to technological changes can sustain within the IT business for a protracted time. Of the various pressing problems haunting the early start-ups today, the process improvement one is the most crucial one. In an era, where everyone is turning lean and incorporating agility, for any SME IT firm to initiate the route to success, it is pivotal to identify the activities in the existing process that do not add any value to it and eats up the resource. Time and space, and also incorporate measures to eliminate them. The current paper discusses only four such activities and whether they are posing as a bottleneck to the IT community. It is clear from the above studies for smaller companies' catering to small projects, the factors studied here are make a difference, and collectively are capable of impacting the overall project schedule and process being followed. It also a known fact, that the list is far from being exhaustive, multiple such factors do exist which often vary according the type of service being offered by the firm as well. The future work of this would be to identify and expand the current list and bring forth more such problem areas and thereafter propose a framework which would help in handling such issues.

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