

IT Project Management in Very Small Software Companies: A Case of Pakistan

Research-in-Progress

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ABSTRACT

In developing countries very small software companies (VSSCs) with only 1-10 employees play an important role both in the local economy and as providers of software and services to customers in other parts of the world. Understanding and improving their IT project management (ITPM) practices and challenges are, therefore, important in the local as well as the larger context of globalized software development. There is, however, very little research into small shop software practices in developing countries. The current paper explores actual ITPM practices in Pakistani VSSCs based on a qualitative study of seven Pakistani VSSCs. We find that some Pakistani ITPM practices are similar to what is reported from VSSCs in other parts of the world, while others seem to be related to the companies' position in the global software development chain. The paper is part of a larger research project aiming to explore and compare software development practices in Very Small Software Companies in Pakistan and Denmark

Keywords

IT project management, developing countries, PM tools, very small software companies, freelance portals, PM issues and challenges

INTRODUCTION

Small software companies play a major role in many economies in the world. (Laitinen et al., 2000; Richardson and Wangenheim, 2007; Wangenheim et al. 2006). In Europe, around 85% of small software companies have 1 to 10 employees. (Francisco et al., 2010) These software companies contribute 93% of all IT businesses in Europe and 66% of total employment in the software industry (Basri and Connor, 2010; Francisco et al., 2010). A survey conducted in Denmark finds that around 89% of IT companies have less than 10 employees. In 2005 a US survey found that around 80% of companies in the areas of software publishing and customer computer programming services have less than 10 employees (Babb, 2009). In India small IT companies represent up to 85% of all software organizations (Richardson and Wangenheim, 2007). Pakistan and India share almost the same culture and business structure and we estimate a similar distribution in the Pakistani software development sector; i.e. that VSSCs with 1-10 employees comprise around 85% of the total number of Pakistani software companies.

Small and medium sized companies are often bundled in organizational studies (as SMEs) but the characteristics and limitations of VSSCs differentiate them from medium sized software companies. (Richardson and Wangenheim, 2007; Fayad et al., 2000)

VSSCs have limited financial resources and a narrow set of developer skills compared to medium and large companies. They operate in a very competitive market and, their software development process is primarily driven by time to market and short development cycles. It is characterized by high flexibility and risk orientation, unstructured planning and informal managerial process, and the companies have limited learning and knowledge absorption capacity (Babb and Nørbjerg, 2010; Fayad et al., 2000; Laporte et al., 2008; Richardson and Wangenheim, 2007). Small companies in developing countries face further challenges i.e. low human resource capabilities, technological capabilities, poor project management competences, lack of skilled manpower, deficiencies in marketing strategies, low efforts on R&D and lack of innovative technology (Viral, 2012). SMEs in developing countries like India and Pakistan also face system specific problems; e.g. lack of corporate governance structures, competition, corruption, barriers to trade, bureaucratic legal and regulatory frameworks, and limited access to capital and/or harsh collateral requirements (Viral, 2012; Fredriksson et al., 2012). By comparison, SMEs in developed

countries have become a well-developed sector (i.e. research & development, technological aspects) (Munns and Bjeirmi, 1996).

There is remarkably little research into software engineering (SE) practices in VSSCs given the large number of companies, their economic impact, and their unique characteristics (Babb, 2009; Fayad et al. 2010; Francisco et al., 2010; Laitinen et al., 2000; Kautz, 1997; Richardson and Wangenheim, 2007) and there are even fewer studies of VSSCs in developing or transitional economies. In this paper we analyze data from an interview study in Pakistani VSSCs in order to identify characteristics and challenges of their IT Project Management practices. The research is part of a larger research project aiming to study and compare Software Engineering practices in Pakistan and Denmark.

The paper is structured in six main sections: Related Work, research method results from the interview study, discussion and conclusion.

RELATED WORK

One strand of research into SE practices in VSSCs has been concerned with software process assessment and improvement (Francisco et al., 2010; Kautz, 1997; Pino et al. 2007; Rainer and Hall, 2001; Sulayman et al. 2011; Wangenheim et al. 2006) CMM, ISO 15504, and IDEAL are the most frequently used software process improvement (SPI) frameworks in medium size companies but these are generally not adopted by VSSCs (Basri and Connor, 2010; Pino et al. 2007; Laitinen et al., 2000) since these frameworks are considered to be too costly and cumbersome to apply in the VSSC context (Lester et al., 2010; Wangenheim et al. 2006). Generally, it appears that methodologies, guidelines, tools, documentation requirements, and managerial practices used in larger companies do not fit the VSSC context very well due to their size and other constraints (Fayad et al., 2000, Babb and Nørbjerg, 2010). Some researchers have, therefore, studied how to adopt and adapt software engineering methodologies and practices to the VSSC context; e.g. agile methods (Babb, 2009; Babb and Nørbjerg, 2010), configuration management (Kautz, K. 1997), reuse, and knowledge management (Pino et al. 2007; Richardson and Wangenheim, 2007).

The management community in general and project management community in particular have, however, developed little guidance for SMEs to manage their projects and Project Management Institute has specified that further research is required to streamline Project Management Body of Knowledge (PMBok) for SMEs (Turner et al., 2012).

We have been unable to locate any explorative study of Pakistani SMEs or VSSCs. VSSCs in developing countries do, however, play an important role both locally and as providers of software and services to customers (other software companies or the actual buyer of the product or service) in other parts of the world (Fredriksson et al., 2012) Understanding and improving their practices and challenges is, therefore, important not only in the local context, but also in the context of globalized software development.

RESEARCH DESIGN

This study is based on interview data from 7 independent VSSCs in Pakistan whose primary business is software development. Pakistan was selected primarily because one of the authors of this study has easy access to the country, as well as being familiar with the culture and local languages. The qualitative approach is consistent with the exploratory nature of the study the need to understand the organizations in the environment in which they operate (Hazzan et al., 2006).

We have interviewed seven VSSCs in Pakistan. Two companies develop and market a software product, while the other five work for clients; i.e. they are project based. We intended to interview two persons in each company and with the exception of two companies (A and B), we were only able to get access to two persons and in rest of five companies, we were able to manage one interviewee from each company. Refer to table 1 for further information about the companies and interviewees. The duration of each interview was about 45 minutes. All interviews were recorded on a handheld smart device as audio files. The first two interviews were transcribed and analyzed prior to subsequent interviews in order to improve the questionnaire and interview technique.

Semi structured interviews (open-ended) technique has been used to elicit data to allow the interview to evolve according to the participant involved. The technique is flexible, and it provides opportunity for the interviewers' improvisation and exploration of the studied objects (Runeson and Höst, 2009). Data was analyzed using Grounded Theory (GT) (Strauss and Corbin, 1997). This involves development of codes associated with collected data, code categories, inter-relationship of code categories and their sub categories, and integration and refinement of theory.

Company ID	No. of Employees	Interviewees	Application Domain	Company Type
Company A	8	Project Manager & Senior Software Developer	Web application design & development	Project based
Company B	8	Project Manager & Senior Software Developer	Web application design & development	Project based
Company C	7	Project Manager	Web application design & development	Project based
Company D	5	Project Manager	Utility applications development	Project based
Company E	9	Project manager	Web application design & development	Product based
Company F	8	Project manager	Web application design & development	Project based
Company G	10	Project manager	Financial Applications	Product based

Table 1. Details about VSSCs and the Interviewees

PM CHARACTERISTICS OF PAKISTANI VSSCS

Our analysis resulted in the identification of seven key characteristics of the PM practices in the VSSCs:

- Several intermediate business layers
- Non-standard tools
- Customer control
- Multiple responsibilities
- No access to the end user
- Unsystematic version control
- No project management training

Several Intermediate Business Layers

60% to 70% of the Pakistani VSSCs' business come from customers located in the US, UK, Australia, and South Africa while the rest are small projects for local customers. The overseas customers are online businesses like real estate business, online shopping carts, and social networking websites as well as brick-and-mortar companies like barbers, designers, shop owners, reporters, and celebrities who want a web presence. The VSSCs and these end customers are, however, separated by several intermediate business layers: Often, the VSSCs find their customers through online freelance portals/websites. The companies or individuals posting projects to these websites may be the final customer, but often they are an intermediary located outside Pakistan, who gets projects from local clients and so forth. Sometimes a local company in; e.g. the US have a contract for a larger project and they contact a local intermediary who in its turn hire an IT consulting company with experience in the; e.g. web technologies to prepare a requirements specification. This document is then given to the intermediary company who has access to overseas web development companies like a VSSC in Pakistan. In this way, four layers exist between the end user and VSSCs in Pakistan.

In some cases, it gets even more complex as the Pakistani VSSC may choose to hire another local company produce all or part of the software. Consequently, five possible business layers separate the customer and the VSSC in Pakistan With the end user being yet another layer removed (see figure 1).

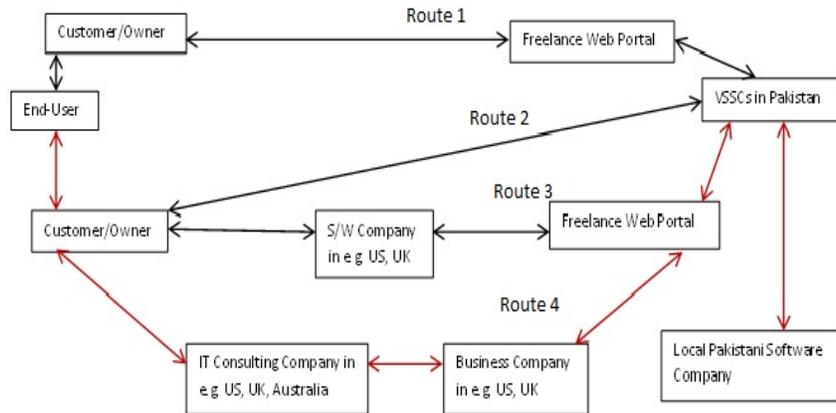


Fig. 1. Business Layers between End-User and VSSCs in Pakistan.

The many intermediaries result in delays in feedback from the end-customer to the VSSC. If a project has been delivered in two months, then the VSSC may wait for 2-3 months up to a year before the client returns with the end-customer's feedback.

Non-Standard Tools

There is a long range of PM tools available and it is almost impossible to develop software without tool support. These tools are used throughout the whole software development life cycle (SDLC) i.e. project management, requirements engineering, design, implementation, and software testing (Richardson and Wangenheim, 2007). The respondents from the VSSCs do not find, however, that current PM tools fit their needs and that they are far too time consuming and complicated to use. VSSCs need a time efficient PM tool that can help them manage around 20 small web projects simultaneously. After trying out 4-5 PM tools, some VSSCs have created modified tools that meet their requirements.

Customer Control

The client would often have the dominating role in the relationship with the VSSC. The client dictates project parameters; i.e. cost and duration of a project, and their feedback drives development activities. They control the completion of a project, they have access to the VSSC's PM tools to see the status and give feedback, and they have direct access to local developers and project managers whom they assign tasks and dictate the process to be followed. For example, one client has given Company F access to their online PM tool called PM Bubble. The project manager from Company F can get project details like number of tasks, project cost, start time, completion time, and comments about the project. Project manager at Company F is bound to update project status on this PM tool. On the other hand, product based VSSCs have their online customer support system to get feedback from their customers/users and they don't face customer dictates.

Multiple Responsibilities

Every employee in the VSSCs has multiple responsibilities. Most of the project managers also participate in software development, software testing, business development, and other managerial tasks. In addition to this, the project manager is responsible for client communication. The software developer is also responsible for software design, and software testing. There is only one position that does not have multiple responsibilities, the business developer who keeps an eye on freelance portals and tries to fetch new clients. He also maintains and optimizes the company's visibility in Google searches.

No Access to the End User

By 'end user' we here refer to an individual or a group of people who uses the final software product. In some cases the customer/client is also the end user, but if the product has been made for an open market then user and customers are different identities. Therefore, it is very important to get inputs and feedbacks from end users during a development process (Munns and Bjeirmi, 1996). The VSSCs in our study, however, are isolated from the end-user by several layers of intermediaries, as described above. In fact, they rarely even have access to the customer who originally ordered the product, but only to an intermediary, who, in his turn, may also be several steps away from the customer and end-user. In this way, project managers at VSSCs in Pakistan are sometimes unable to get the real users' inputs and feedback needed to run a successful PM process.

Unsystematic Version Control

The Pakistani VSSCs have an ad hoc and unsystematic approach to version control. They keep track of different versions of a project through email history, some of them use Dropbox tool, hyperlinks to different versions of a project in a dedicated space on their websites, or self-developed PM tools like company C, and company E.

Lack of Project Management Training

Most of our interviewees are the owner of their companies and they have a bachelor degree in Computer Science or Information Technology. They don't have specific ITPM training or certifications but they have switched from software development to PM. The project manager from Company E, for example, has a Master degree in Software Engineering and another was studying for a bachelor degree in chemical engineering when he started working in Photoshop to design and develop websites. He gradually made it his profession by picking up projects from freelance websites and as business picked up, and he got more projects he found himself more involved in these activities, and decided to leave chemical engineering and devote his time to website design and development.

What makes project managers confident about running projects at the VSSCs is their experience from previous projects and they are normally not concerned with their lack of PM training, but when they get a bigger and more complex project they feel the need to make things more formal.

CHALLENGES FOR PM PRACTICES IN PAKISTANI VSSC

The issues and challenges facing the Pakistani VSSCs have implications for their PM practices. Space does not permit a systematic comparison with the recommendations from the ITPM literature; e.g. the PM Body of Knowledge (Project Management Institute. 2008), but we will summarize and discuss our findings in the following paragraphs.

The project managers' multiple responsibilities keep them away from practicing systematic PM. They spend a large part of their time in communication with clients and with developers. Therefore, it is very difficult for them to develop and maintain project plans, systematically monitor progress, document activities or perform systematic project evaluation. In addition to intensive communication, project managers at VSSCs in Pakistan also participate in software development and software testing. Besides having many tasks/responsibilities, developers/project managers also have to deal with updates, defect handling from clients, and problem-solving meetings. Excessive multitasking for an engineer causes disruption and fragmentation in work, and it provides less opportunity for recuperation, and competence development (Vähäniitty et al., 2010).

A project may travel through three to five business layers before it reaches the VSSC in Pakistan. These business layers leave a communication gap between project managers and the end-client/user. This communication gap impacts the quality of the project and it also causes delays in feedbacks and in payment transfers to the VSSCs. Late feedback response from the clients causes problems in resource planning, delay in project delivery, and it restricts the project manager from planning further software development activities.

Long indirect communication chains are reported to create ambiguities and misunderstandings in design processes (Melnik and Maurer, 2004). When a change in requirements is requested by the end client and travels through all possible layers and reaches the project manager in Pakistan, it is not guaranteed that the particular change request is the same as the end client requested. In a similar way, design suggestions or questions from the VSSC may become distorted before reaching the end customer.

The long chain of intermediaries has economic implications for the VSSCs as well, since the client does not pay to VSSC until the final product is operational and approved by the original customer. This process, which may involve activities and components outside the control of the VSSC can delay payment from anywhere between two months to a year. During this period, VSSCs may still receive requests for small changes and bug fixes.

The end-user's involvement in PM process is an important prerequisite for the success of a project (Munns and Bjeirmi, 1996) but in the Pakistani VSSCs in Pakistan don't have access to the end users, but only to their immediate client. Consequently, clients take very long time to validate the web product. If a project has been delivered in two months then the client (middle company or direct client) take from two to three months to a year to validate a delivery.

In case of project based VSSCs clients may take responsibility for PM and set project cost and duration. They have access to PM tools at the VSSC to see the status and give feedback against projects, and they may even directly control developer activities. In this way, the local project manager loses control over project planning, scheduling, project directing, and project control.

Most of VSSCs do not use standard PM tools such as: e.g. MS Project in practice. There are two reasons for this, first they believe that standard PM tools are time consuming and secondly they find them complicated. Consequently, project managers at these VSSCs are facing omission of data, and rework issues. But on the other hand, two VSSCs have developed their own PM tools and these tools are exactly according to their PM requirements. This is a sign that VSSCs in Pakistan may be slowly maturing their software development processes in their own manner. SE literature states that VSSCs have a perception about SPI standards that they are overly involved, complicated, missing detailed implementation guidance, and they require extra resources that would be additional cost to the company. (Laitinen et al., 2000) VSSCs are unable to afford the cost of extra resources and they don't see any net benefit in applying software processes, models (CMM, CMMI) or standards (ISO/IEC 12207). (Laitinen et al., 2000) Therefore, the trend of making existing SE tools, techniques, models, and SE standards according to the requirements of VSSCs should be promoted in SE literature.

All project managers at VSSCs in Pakistan have been switched from software development to PM. They don't have specialized training in PM and PM tool usage. Consequently they are unaware of the software engineering literature and its recommendations, and they are ignorant of PM methods and PM techniques. But when they get a big project then they feel the importance of academic knowledge in SE and they wish to make things formal. This is because a big project brings complexity in work, good finance, and enough time.

Are Pakistani VSSCs 'Different'?

A question is, whether Pakistani VSSCs are different from VSSCs in developed countries. The present study is the first step in a research project aiming to make such comparisons, and in addition, it is exploratory and descriptive. Furthermore, does not permit a systematic comparison with previous research into VSSCs, but it is clear that the Pakistani VSSCs share many of the characteristics previously reported from studies of VSSCs in other settings; e.g. short delivery cycles, multiple tasks and responsibilities of employees, poor or missing project planning and documentation etc. (Babb and Nørbjerg, 2010; Basri and Connor, 2010; Fayad et al., 2000; Lester et al., 2010). Thus, we may assume that these characteristics follow from common structural and contextual properties of the VSSCs; e.g. narrow skill base, low financial strength, little time for learning etc.

It seems, however, that the position at the end of a long and complex software production chain, does create additional constraints for the Pakistani VSSCs (and with them perhaps other VSSCs in emerging economies). Their clients are companies in other countries whose strength vis-a-vis the local VSSC allows them to dictate most of the conditions of the project to the point where the Pakistani VSSC becomes little more than a supplier of labor. The delays in communication between the VSSC and the end customer also increases the risk of communication distortion. The distance and intermediate layers also contribute to the financial challenges facing the VSSCs due to long delays in payment.

These observations open up further research into the structure and dynamics of global software production chains and the position of developing countries in those chains. They also emphasize the need for more systematic comparisons between VSSCs in developing and developed countries.

CONCLUSIONS

Our results show that Pakistani VSSCs are facing many issues related to ITPM in the local as well as in the global context. Locally they are facing challenges of multiple responsibilities, lack of PM tools that can fulfill their unique PM requirements, insufficient PM training, lack of software version control tools, and unavailability of end-users who play important role in project success. Globally they have to face PM dictates from their clients (mostly software companies), they are separated from their end customers by many intermediate, and they are facing problems of information distortion, misunderstandings, incompleteness, delay in payments and delay in project delivery. The intermediaries also keep VSSCs away from practicing agile methodologies because agile methods purely focus on direct and face to face communication among individuals (customer-developers) that in case of most of Pakistani VSSCs, is almost impossible.

We do, however, also see signs of increasing maturity among some of the VSSCs and some of them are adapting PM tools and practices to their own needs. This is a promising sign that VSSCs in Pakistan are trying to professionalize their practices, but it also points to the need to create SE standards, SPI models, SE tools, and methods according to the requirements of VSSCs.

Finally, several of the characteristics of Pakistani VSSCs that we have found, such as poor documentation and planning, short delivery cycles and adaptation or non-use of standard software engineering recommendations, tools, and techniques, are similar to findings from studies of VSSCs in other settings. Thus, along some dimensions, there seem to be little or no difference between VSSCs in developing countries like Pakistan, and in countries like USA, UK or Denmark. The long and complex chain of intermediaries between the Pakistani VSSC and the end customer, does, however, appear to cause special

conditions, and limitations, for the ability of the Pakistani VSSCs to adopt mature PM practices. Future studies, including comparisons with VSSCs in developed economies, will investigate this question further.

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