

## Implementing Software Process Improvement Initiatives: An Analysis of Vietnamese Practitioners' Views

Muhammad Ali Babar<sup>a</sup>, Mahmood Niazi<sup>b</sup>

<sup>a</sup> *Lero, University of Limerick, Ireland*  
[malibaba@lero.ie](mailto:malibaba@lero.ie)

<sup>b</sup> *School of Computing and Mathematics, Keele University, ST5 5BG, UK*  
[mkniazi@cs.keele.ac.uk](mailto:mkniazi@cs.keele.ac.uk)

### Abstract

*There is a vital need for gaining a solid understanding of different aspects of implementing SPI initiatives in organizations involved in software outsourcing and/or off-shoring, which are parts of Global Software Development (GSD) phenomenon. However, little attention has been paid to understand difficulties and challenges involved in implementing SPI programs in developing countries like Vietnam and Malaysia, which are emerging as key players in the context of GSD. This paper presents findings from an empirical study aimed at exploring practitioners' experiences and perceptions of different aspects of implementing SPI initiatives. Face-to-face meeting sessions were conducted with twenty-three software development practitioners from eight Vietnamese software development organisations, which were involved in software outsourcing contracts and had initiated SPI programs. The results provide interesting insights into different aspects of SPI initiatives. We expect that the findings can provide some advice to SPI practitioners on what needs to be addressed when developing SPI implementation initiatives in countries like Vietnam.*

### 1. Introduction

Software Process Improvement (SPI) has been a long-standing approach promoted by software engineering researchers, intended to help organisations to develop high quality software more effectively and efficiently. Process capability maturity models such as CMM, CMMI [1] and ISO/IEC 15504 (SPICE) are SPI frameworks for defining and measuring processes and practices that can be used by software development organisations. Research shows that the effort put into SPI can assist in producing high quality software, reducing cost and time, and increasing productivity [2-4]. Recently, many companies are also adopting the

Global Software Development (GSD) paradigm to reduce software development cost. The scope of GSD is expanding from focusing only on reducing cost to improving organisations' overall software development capabilities.

This change has led to a realisation of an increasingly important role of SPI initiatives in the context of GSD. This research is premised on the need to gain an in-depth understanding of different aspects of successfully implementing SPI initiatives in organizations involved in software outsourcing and/or off-shoring, which are parts of GSD phenomenon. It is assumed that an SPI program in the context of GSD usually requires more initial investment than a similar program in a non-GSD environment. Moreover, managing an SPI program in the GSD context is expected to be far more complex and difficult because of the geographically distributed locations and lack of reliable infrastructure for GSD teams [5].

We believe that SPI practitioners face new challenges such as developing global SPI practices, creating confidence and trust among the vendor and customer companies, managing the expectations of what can and what cannot be done in a distributed setting, and understanding the human and cultural specific aspects of SPI initiatives. To successfully address these challenges, SPI practitioners need to gain a solid understanding of the changing mechanics of designing and implementing better SPI initiatives in the context of GSD.

Despite the increasing importance and need for empirically tested body of knowledge on different aspects of successfully implementing SPI initiatives, there has been little research carried out to understand difficulties and challenges involved in implementing an SPI program based on assessment models like CMMI in developing countries like Vietnam and Malaysia, which are fast becoming the prime destinations for outsourcing and/or offshore development centres of companies from America,

Europe and Asia alike. However, implementing an SPI program is considered quite difficult in countries like Vietnam as many of the companies are not only SMEs but are also resource constrained; hence, SPI becomes quite challenging [6].

Our long term research goal is to provide SPI practitioners with a body of knowledge that can help them to design and implement successful SPI initiatives in developing countries, which are emerging as new players in software development outsourcing and off-shoring in the context of GSD. In this paper, we present the findings of an empirical study aimed at understanding the reasons for and challenges involved in implementing SPI programs. This work is expected to provide SPI practitioners with some insights into different aspects of SPI initiatives in developing countries like Vietnam. The findings also complement our previous research on this topic with the Australian SPI practitioners [7]. Hence, we also consider this study as a replication of our previously conducted research aimed at helping SPI practitioners to design and implement appropriate SPI strategies in order to achieve better results.

There are four research questions that have motivated the work reported in this paper:

1. RQ1 - Why different Vietnamese companies embark on SPI initiatives?
2. RQ2 – What are the overall views of Vietnamese practitioners about different aspects of the SPI programs in their organisations?
3. RQ3 - What barriers have undermined the SPI implementation initiatives in Vietnam?
4. RQ4 - How are these barriers related to the size of organisations?

This paper is organised as follows. Section 2 discusses the background for this research. Section 3 describes the research design. Findings are presented in Section 5 and 6 provide limitations of and conclusions from the research respectively.

## 2. Background

Despite the different advances made in the development of SPI standards and models, the failure rate for SPI programmes is quite high. The recent report from the Software Engineering Institute (SEI) puts the rate of failure at around 70% [8, 9]. We argue that one of the reasons for this situation may be a lack of attention being paid to SPI implementation issues.

A number of empirical studies (reported in [10-15]) have investigated factors that positively or negatively affect an SPI initiative. To highlight a few of these factors, Butler [14] describes SPI activities and lessons

learned at the Oklahoma City Air Logistics Centre between 1990 and 1996. Diaz and Sligo [15] describe how SPI helped Motorola. They also describe different factors that contributed to the success of their SPI efforts at Motorola. A questionnaire based survey of 85 UK companies [13] identified the key success factors that are expected to have impact on SPI initiatives. Niazi et al [16] have conducted a study with 34 Australian practitioners and have identified factors that are expected to positively impact an SPI initiative.

The work we report in this paper complements previous work done in this line of research as mentioned above. However, the nature of SPI implementation issues may change in the context of GSD. Moreover, our study has been conducted in a country that is increasingly becoming an attractive destination for software development outsourcing from Western and Asian countries alike [17]. Hence, studying different aspects of SPI programs in one of those countries, which are becoming significant players in software development industry in the context of GSD, is another important motivator of this research as described in the following paragraph.

Software development outsourcing and/or off-shoring have become quite common models of GSD paradigm. In the software export market, India is a dominant software outsourcing provider, accounting world-wide for an estimated over 80% of the total offshore development revenues [18]. However, in recent years, other countries like Israel, Russia, China, Philippines, Taiwan, Singapore and Vietnam are gaining a reputation for offshore outsourcing [19]. Vietnam, although still listed as a tier-4 nation amongst the software exporting countries classification [20], has recently become more attractive for outsourcing work due to “positive macroeconomic changes and investments from government and multi-lateral organisations, a cost-effective workforce, improving infrastructure, linkages with key markets and an ambitious national vision” [17]. Due to an increasing interest in getting software developed in Vietnam, SPI initiatives are gaining attention in these countries [21]. However, due to Vietnam’s relatively new position in the software outsourcing business, there are no previous studies on software engineering practices in general and different aspects of SPI initiatives in particular. As a result, a study on different aspects of SPI initiatives is expected to provide useful insights into the Vietnamese practitioners’ perceptions about the motivation, benefits and challenges involved in implementing SPI programs. Such insights can benefit SPI practitioners and/or managers from the developed countries who are usually assigned to work with software developers from the developing countries to assess and/or improve their development processes.

### 3. Research Design

#### 3.1 Study Methodology

We used face-to-face questionnaire based survey sessions as our main approach to collect data from twenty-three software development practitioners of eight Vietnamese software development companies, which had initiated SPI programs. Though we do not claim this is a statistically representative sample, the participants of this study were working for organisations of varying sizes. It is also worth mentioning that the data was collected from practitioners who were involved in tackling real SPI implementation issues on a daily basis in their respective organisations. It is also important to acknowledge that the practitioners selected for the study were considered the representatives of the practitioners in organisations as a whole.

Since a truly representative sample is impossible to attain, the researcher should try to remove as much of the sample bias as possible [22]. In order to make the sample fairly representative of SPI practitioners in a particular organisation, different groups of practitioners from each organisation were selected to participate in this research. The sample of practitioners involved in this research includes developers, quality analysts, SQA team leaders, SQA managers, project managers, and senior managers. Thus, the sample is not random but a convenience sample, because we sought a response from a person with a specific role within a software development organisation.

#### 3.2 Data Collection and Analysis

We used a closed ended questionnaire as an instrument to collect self-reported data. The questionnaire was designed to gain an understanding of the Vietnamese practitioners' views about the reasons for, different aspects of, and barriers to implementing SPI programs in their respective organizations. Most of the questions in the questionnaire were based on the list of reasons for embarking on SPI initiatives and barriers to SPI implementation reported in [7, 23]. The questionnaire was also designed to elicit the perceived level of effect of each barrier to SPI implementation (perceived criticality). Hence, the respondents were supposed to mention the level of effect (i.e., High value, Medium value, Low value, Zero value, or Not sure) of each barrier to SPI implementation. We used the responses about the level of effect to introduce the concept of '*perceived criticality*' for each identified barrier as explained in the following.

In this study, we define '*perceived criticality*' to mean the severity of negative effect of a certain factor on SPI implementation perceived by the respondents. This may be considered to be a subjective view as it is provided by the respondents of this study. However, our respondents are considered SPI experts within their organisations. Hence, we can assume that their opinion is grounded in significant experience of real world SPI initiatives. In order to determine the '*perceived criticality*' of each identified barrier, we have used the following criterion:

- If the majority of respondents ( $\geq 50\%$ ) perceived that a barrier had high effect on the SPI implementation then we treat that barrier as critical.

A similar approach has been used in the literature [13, 24]. Rainer and Hall [13] identified important factors in software process improvement with the criterion that if 50% or more participants perceive that a factor has a major role in software process improvement efforts then that factor should be treated as having a major impact on software process improvement. We assert that the '*perceived criticality*' of SPI barriers can act as a guide for SPI practitioners when implementing SPI initiatives because it will be easier to take appropriate measures to address a limited numbers of factors that can undermine an SPI implementation initiative.

For analysing the data, we used frequency analysis, which is usually the most frequently used approach for similar studies by other researchers [25, 26]. The presentation of data along with their respective frequencies is an effective mechanism for comparing and contrasting within or across groups of variables. In order to analyse the '*perceived criticality*' of each identified barrier to SPI implementation, the occurrence of a perceived effect (high, medium, low, zero) in each questionnaire was counted. By comparing the occurrences of one barrier's perceived effect obtained against the occurrences of other barriers' perceived effect, the relative criticality of each barrier has been identified. We have also used this approach to identify the high '*perceived value*' practices of CMMI level 2 [27].

#### 3.3 Study Procedure

The responses to the questionnaire were gathered during September 2005. The respondents were employees of eight software development companies, which had agreed to participate in our research. Two of the companies sent an apology before the data collection process started as their employees were too busy to be able to participate in the study. We had

requested the participating companies to nominate at least two employees to participate in this study. We managed to administer the survey instrument to more than two software development practitioners from some companies. Though, all the participants were well-versed in English and the questionnaire was in English, the research team had a Vietnamese speaking researcher, who could have provided necessary explanation if required.

Two weeks before the execution of the study procedure, the participants were provided, via email, the details of the process and procedures for the survey sessions. In order to safeguard the confidentiality of the data and privacy of the participants, we also sent a statement of the ethical principles the research team would follow. However, we did not provide the participants with the questionnaire in advance in order to avoid any pre-judgment bias. At the start of each survey session, the participants were again assured that their data would not be accessible to anyone except the research team. Furthermore, we explicitly made it clear to the participants and their companies that the research team would not share the data with anyone in a way that could reveal any participant's or company's identity. All the survey sessions were conducted in face-to-face meetings at the participants' offices in an environment free of distractions. Each survey session lasted approximately 60 minutes followed by 10-15 minutes debriefing session.

## 4. Finding

### 4.1 Demographics

Table 1 presents the demographic information about the participants of this study. As previously mentioned, twenty-three practitioners from eight Vietnamese companies involved in software outsourcing participated in this study. Since we also wanted to analyse the participants' responses based on the sizes of their respective companies, we divided their companies into different groups based on their sizes in terms of number of software development staff. Using the company size definition provided by the Australian Bureau of Statistics [28], we divided the participants' companies into three categories: SMALL (0 to => 19 employees), MEDIUM (20 to => 199 employees), and LARGE (200+ employees). According to this categorisation of the companies, six are small-medium sized and two are large sized companies.

### 4.2 Reasons for SPI initiatives

In order to answer the RQ1, our study intended to determine the main reasons for Vietnamese companies' SPI initiatives. Researchers have reported several reasons for initiating or not initiating SPI programs using process improvement and assessment models like CMMI or SPICE. Table 2 shows the factors that Vietnamese practitioners perceived as the main reasons for their companies to embark on SPI initiatives.

Table 1 Demographics

ID	Employees	Participants	Titles of participants
1	80	2	Project manager, Team leader
2	70	6	Developer, Test leader, Programmer, Divisional head, Developer, QA manager
3	150	2	Chief Technology Officer, QA manager
4	150	3	Design team leader, R&D team leader, QA team leader
5	700	2	Project Manager, Process quality manager
6	150	2	QA Manager, Operation manager
7	50	4	QA manager, Project engineer, Project leader, Project leader
8	200	2	QA coordinator, QA manager

Table 2 shows that 83% of the Vietnamese practitioners think that from SPI their companies wanted to reduce development cost and to improve quality of the software product. These results have confirmed the results of our previously findings from a study conducted in Australia [7] where 73% of the Australian practitioners wanted to improve the quality of the software product and 50% of them wanted to reduce the development cost. The other frequently cited reason is "to improve customer satisfaction". Seventy percent of the Vietnamese practitioners embarked on SPI initiative to: reduce rework, improve management visibility and meet customers' demands. It shows that practitioners are interested to shortening software development cycle times, to increase productivity and to improve predictability of schedule.

### 4.3 Overall Views about SPI Programs

In order to determine the participants' overall views about the different aspects of the SPI programs being implemented in their respective organisations, we used two single item and one multiple item questions. The single item questions were:

1. Do you consider SPI an effective approach to improving the quality of the software product?
2. Has the process improvement program provided expected and clear benefits to management?

In response to the first question, the participants appear to be very positive about the effectiveness of SPI in improving product quality. Ninety one percent of them strongly agreed or agreed that SPI is an effective approach to improving the quality of software product. Only 9% of the respondents considered otherwise. However, they did not provide any explanation as why they considered SPI is not an effective approach to improving product quality.

Table 2: Reasons for embarking on SPI

Reasons for embarking on SPI initiatives	Occurrence in surveys (n=23)	
	Freq	%
To reduce software development cost	19	83
To improve the quality of the software developed	19	83
To improve customer satisfaction	19	83
To reduce rework	17	74
To improve management visibility in software development	16	70
To meet customers demands	16	70
To shorten software development cycle times	15	65
To increase productivity	15	65
To improve predictability of schedule	15	65
To improve the relevant development documentation	12	52
For public relations/marketing purposes	12	52
To reduce time-to-market	9	39

In response to the second question, again 91% of the participants considered that SPI initiatives in their organizations have provided expected and clear benefits to their management. Only 4% of the practitioners are of the opinion that SPI initiatives in their organization did not provide the expected benefits to their management. Our results are in line with other studies that showed that the effort put into SPI can assist in producing high quality software, reducing cost and time, and increasing productivity [2-4, 29, 30]. In addition, our results also support the findings of our previous study in Australia [7] where 71% of the Australian practitioners reported that SPI initiatives had provided expected and clear benefits.

The third question consisted of multiple items. Each item in the question was a statement for which we sought the participants' responses against a five-point scale (i.e., Strongly agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), and Not Sure (NS)). The items on the questions were intended to explore the participants' experiences and perceptions of different aspects of SPI initiatives in their respective organisations. Table 3 presents the frequencies of responses for each of the items included in this question. The first two items of the question were designed to determine whether or not Vietnamese organisations underestimate the cost and time commitments for implementing an SPI program.

Table 3 shows that a large number of the respondents did not think that SPI initiatives were costly than expected. A majority of the respondents felt that SPI initiatives had taken longer than expected. This finding is in line with the findings from many previous studies, which have reported that SPI programs usually take longer than expected. Table 3 also shows that a majority of the respondents felt that they were facing difficulty in designing and deploying new processes in their organisations and almost all of the respondents emphasised that they needed technical support and training in skills required for designing and deploying new processes. Table 3 also reveals that a majority of the respondents were of the view that things had changed since the SPI initiative. It shows that the participants had positive views about the effect of the SPI programs in their organisations. However, a majority of them reported that SPI initiatives had suffered from time and resource limitations.

These findings provide useful information about different aspects of the SPI initiatives in Vietnamese organisations, which participated in this research. We have found that majority of the participants of this study appear to be supportive of the SPI programs in their organisations. However, they need training and skills for designing and deploying new processes. Moreover, they are also of the view that more resources and time should be allocated to the SPI programs. We assert this information can be very useful for companies outsourcing to and/or having offshore development centres in Vietnam and intend to improve the software development processes of their vendors or subsidiaries. Such companies can take into account these findings in their plans for providing training to their staff in SPI and allocating resources to SPI initiatives.

Table 3: Questions used to gain an understanding of different aspects of the SPI programs.

Items on the questionnaire	SA	A	D	SD	NS
Process improvement is more expensive than we expected.	3	5	11	0	4
Process improvement has taken longer than we expected.	4	9	7	0	3
Software processes have become more bureaucratic.	1	5	9	2	6
Designing a new process is difficult.	<b>8</b>	<b>12</b>	2	0	1
We need training to design new processes.	7	<b>15</b>	0	0	1
We need technical support and skill to design new processes.	<b>10</b>	<b>13</b>	0	0	0
Deploying a new process is difficult.	<b>6</b>	<b>11</b>	5	1	0
We need training to deploy new processes.	<b>6</b>	<b>17</b>	0	0	0
We need technical support and skill to deploy new processes.	<b>5</b>	<b>17</b>	0	0	1
Nothing much has changed since SPI initiative.	0	3	13	1	6
Process improvement has suffered due to time and resource limitations.	3	14	1	0	5

#### 4.4 Barriers to SPI Implementation

In order to answer RQ3, the study questionnaire was designed to gain the opinions of the Vietnamese practitioners about the factors, which are perceived to be barriers to the successful implementation of a SPI initiative. Table 4 shows the barriers to SPI implementation reported by the participants of this study. We asked the participants to rank each barrier on a five-point scale (high, medium, low, zero or do not know) to identify the level of negative effect a certain barrier is perceived to have on implementing SPI.

The “lack of project management” and “lack of resources” are the most commonly reported “critical barriers” by the Vietnamese practitioners (i.e. 61%). However, in other studies conducted in UK and Australia only a quarter of the practitioners cited ‘lack of resources’ as a barrier [23, 31]. One explanation of this finding can be that Vietnam is a developing country, where a large majority of the software development companies are small-to-medium sized organizations, which may not be able to invest as much resources for SPI initiatives as equivalent sized companies in the UK and Australia. So it can be argued that ‘lack of resources’ is inversely proportional to the development of the country. Similarly “lack of project management” is only cited by 10% of the Australian practitioners [23]. This also shows that Vietnamese software development companies need to improve the project management practices and capabilities, which have become more critical in the context of GSD.

Furthermore, nearly half of the Vietnamese practitioners cited “inertia” as a critical barrier to implementing SPI initiative. It is interesting to note that no practitioner in Australia cited “inertia” as a SPI barrier [23]. However, 39% of the UK practitioners mentioned “inertia” as a SPI barrier. This is because of the nature of SPI implementation issues that may

change based on contextual factors, e.g., culture and work ethics. It is also quite common that practitioners of the same organisations placed in different geographical regions may have different opinions on the same aspect of an SPI initiative.

We have also found that another interesting correlation of a barrier with the country, i.e. nearly half of the Vietnamese practitioners cited “lack of sponsorship” as an SPI barrier. However, only 19% of the Australian practitioners and 8% of the UK practitioners have cited this factors as a barrier to SPI implementation [23, 31]. This is quite contrary to the common belief that SPI initiatives in most of the developing countries are driven in a “top-down” fashion in order to be competitive in winning outsourcing contracts. A prime example in this regards is the large number of Indian companies, which have used their certification at a certain level of a well known SPI model (such as CMMI) as a means of gaining trust of their customers. Hence, it is quite surprise that the Vietnamese practitioners experience “lack of sponsorship” for their SPI initiatives. One explanation for this situation may be the lack of resources and pressure to deliver software on low cost.

This study has also uncovered other differences among Vietnamese, Australian and UK practitioners’ views about the factors that can hinder an SPI initiative. For example, more than 40% of the Vietnamese practitioners cited “inexperienced staff” as a high effect barrier. Only 8% of the UK practitioners and 23% of the Australian practitioners have cited this barrier. 17% of the Vietnamese practitioners cited “organisational politics” as another high effect barrier, while this is the most commonly cited barriers in Australia (i.e. 45%). Less than quarter of the Vietnamese and Australian practitioners cited “time pressure” as a barriers but more than half of the UK practitioners think time pressure as a critical barrier.

Table 4: Factors identified as barriers to SPI initiatives by the participants.

Barrier	Occurrence in Surveys (n=23)				
	High	Medium	Low	Not Sure	No effect
Lack of project management	14	5	3	0	1
Lack of resources	14	6	3	0	0
Inertia – laziness	11	7	5	0	0
Lack of sponsorship	11	4	7	1	0
Inexperienced staff/lack of knowledge	10	11	1	0	1
Lack of SPI awareness	10	9	3	1	0
Lack of support	10	8	5	0	0
Lack of communication	8	10	4	1	0
Lack of defined SPI implementation methodology	8	9	5	0	1
Changing the mindset of management and technical staff	7	9	5	1	1
Lack of training	7	13	3	0	0
Time pressure	7	10	4	1	1
Negative/Bad experience	6	10	5	1	1
Lack of tools	5	10	7	1	0
Organisational politics	4	8	4	3	4
SPI gets in the way of real work	3	6	4	6	4
Paperwork required/formal procedures	2	7	9	1	4
Staff turnover	2	10	7	0	4

We have also found some similarities among Vietnamese and Australian practitioners, i.e. “SPI awareness” is cited as a barrier by more than 40% of the Vietnamese practitioners and 36% of the Australian practitioners. We believe awareness of SPI is critical for any SPI implementation initiatives. This is because SPI is an expensive and long-term approach and it takes a long time to realise the real benefits of this approach. Hence, in order to get support of management and practitioners and to successfully continue SPI initiatives, it is very important to provide sufficient awareness of SPI in organisations. By awareness we mean promoting, through awareness events, the long-term benefits of SPI among the higher management and the staff members of the organisation. “Lack of support” is cited as a high effect barrier by more than 40% of the Vietnamese practitioners and 45% of the Australian practitioners. “Lack of defined SPI implementation methodology” is cited as a barrier by 35% of the Vietnamese practitioners and 39% of the Australian practitioners.

#### 4.5 Comparison of SPI Barriers Based on the Sizes of Participants’ Organisations

This research assumes that practitioners from different sizes of organizations would have different patterns of responses about the factors that are perceived to be barriers to successful implementation of SPI programs in their respective organizations. For

example, SM sized organisations can be expected to be more resource-constrained than large organizations in terms of providing sufficient support for an SPI initiative. Since Vietnam is a relatively new player in the software development industry, a large majority of the Vietnamese software development organisations usually fall in the category of SM sized. Hence, there were only four 4 participants in our study from large sized organisations. The rest of them (19) were working in SM sized organisations. A relatively small number of respondents from the large sized organisations made it quite difficult to perform a comparative analysis for discovering the similarities and differences between the SPI barriers perceived by our study’s participants based on the sizes of their respective organizations. Nevertheless, our analysis has provided some useful information.

We find that, in general, there is no significant difference between the SPI barriers reported by practitioners of SM and large sized organisations. For example, our analysis revealed an interesting similarity between SM and large organisations, i.e. the “lack of project management skills” and “lack of resources” are the most commonly mentioned high effect barriers in both types of organisations (58% of SM and 75% of large). As discussed above, software development industry in Vietnam is in its nascent stage and there appears to be an acute shortage of non-computing skills such as project management for developing software. It has also been mentioned that Vietnamese

organisations are not rich in resources. That is why despite a widespread realization of the important role of SPI in attracting outsourced contracts, higher management appears to be unable to allocate sufficient resources to support SPI initiatives in their respective organization. “Inertia – laziness” is another frequently cited high effect barrier by practitioners working for both types of organisations (41% of SM and 75% of large). This is due to the fact that the staff in Vietnamese organisations may not be used to process-based software development practices.

We have also observed that Vietnamese organisations were growing from 10-15 to 100-200 people within the space of 2 to 3 years. Hence, when their staff are asked to follow certain processes as part of an SPI program, they may find those processes difficult to follow and result in inertia. Other frequently cited high effect common barriers are “inexperienced staff/lack of knowledge” and “lack of support” (41% of SM and 50% of large) and “lack of sponsorship” (47% of SM and 50% large).

Our analysis also found some difference between these two data sets, i.e. “SPI gets in the way of real work” is cited by 5% of the respondents of SM organisations and 50% of the respondents of large organisations. “Lack of SPI awareness” is cited by 47% of the respondents from SM organisations and only 25% of the respondents from large organisations. SPI awareness is a commonly cited high effect barrier by the respondents of SM as SPI is an expensive approach and in order to get support of management it is very important to provide sufficient awareness of SPI in organisations.

## 5. Limitations

This research has some limitations that we consider worth mentioning. A disadvantage of the questionnaire-based survey sessions is that respondents are provided with a list of possible reasons, expected benefits, and barrier and are asked to select from that list. This tends to pre-empt the reasons, expected benefits and barriers. This approach may limit the respondents to consider only those reasons, expected benefits, and barriers that are included in the questionnaire based on the existing studies. It is also possible that respondents may misinterpret the questionnaire items. However, we tried to address this issue by explaining the meaning of each of the items included in the questionnaire. Another issue is that the questionnaire-based studies are usually based on self-reported data that may reflect what people think they should say, not necessarily what they actually observe, believe, or perceive. Our results are limited to the

respondents’ knowledge and beliefs about the reasons, potential benefits and barriers that can undermine SPI initiatives. This situation can cause problems when practitioners’ perceptions may be inaccurate. However, like many other studies based on opinion data (such as [16, 32, 33]), we also have full confidence in our findings because we have collected data from practitioners working in quite diverse roles and directly involved in SPI activities within their organisations. Sample size may be another issue as we collected data from only 23 practitioners from 8 Vietnamese organisations. To gain a broader representation of Vietnamese practitioners’ views on this topic, more practitioners and organisations need to be included in a study. Our participants belonged to only one country, Vietnam, which is another limitation as the findings cannot be widely generalized to practitioners from other countries.

## 6. Summary and Conclusions

This paper reports the findings from an empirical study aimed at understanding the reasons, overall views about, and challenges involved in implementing SPI initiatives in Vietnam, which is fast emerging an attractive destination for software outsourcing and/or offshore development centres in the context of GSD. We aimed to provide SPI practitioners with some insight into designing appropriate SPI implementation initiatives in order to achieve better results. To achieve this objective, we have explored the experiences, opinions and views of Vietnamese practitioners in order to identify issues that can have impact on the implementation of SPI initiatives; to determine the reasons for embarking on SPI initiatives in Vietnam; and to reveal the factors that are considered barriers to the successful implementation of SPI initiatives in Vietnam. We expect that the findings of this study can provide some advice to SPI practitioners on what needs to be addressed when developing SPI implementation initiatives in countries like Vietnam. Our results suggest that, in Vietnam, the most frequently cited reasons for embarking on SPI initiatives are to:

- Reduce software development cost;
- improve the quality of software developed and;
- improve customer satisfaction.

This study has also found that 91% of the Vietnamese practitioners perceived that:

- SPI is an effective approach to improving the quality of the software product and;
- SPI program has provided expected and clear benefits to their management.

Moreover, this study also provides information about the participants' overall views about the SPI initiatives in their respective organisations. Based on this information, we can conclude that:

- The participants of this study appear to be quite supportive of the SPI programs in their respective organisations;
- There is an impending need of training and skills for designing and deploying new processes and;
- The participants felt that their SPI programs were characterised by resource and time limitations.

In this research, we have also used the concept of 'Critical Barriers', which are the key areas where management should focus their attention in order to successfully achieve the desired results. Using the criterion for determining the criticality of each barrier described in Section 3.2, we have found that most frequently reported high effect SPI implementation barriers according to the participants are:

- Lack of project management and;
- Lack of resources.

However, the other two barriers, i.e. inertia and lack of sponsorship should also be considered critical during the SPI implementation initiatives as 48% of the participants have described them as having high effect.

We have also found that, in general, there is no significant difference between the SPI barriers reported by practitioners of SM sized and large sized organisations. However, we have found that both SM and large sized companies are having problems with "lack of project management" and "lack of resources" during SPI implementation initiatives.

Our long-term research goal is to build an empirically supported body of knowledge of different aspects of SPI initiatives and assessment in developing as well as developed countries, which are usually involved in software outsourcing. We are approaching this goal by firstly focusing on complementing and/or extending the current understanding about organisational motivations, expected benefits, and involved challenges, and practitioners' attitudes toward and opinions of different aspects of SPI programs being implemented in their respective organisations.

This research has gathered empirical evidence to advance the knowledge about the reasons of and challenges involved in implementing SPI programs in one of the countries where software development is being fast outsourced. The findings also provide empirical evidence to confirm several factors considered SPI implementation barriers by Australian practitioners in our previous study [7]. This study has also revealed that there are many similarities between

the experiences and perceptions of developed and developing countries about the challenges involved in implementing SPI initiatives. Additionally, the study has also identified the areas where Vietnamese practitioners appear to have acute shortage of skills and deficient training (such as project management and designing and deploying SPI practices).

The results also provide information that can be useful for practitioners' understanding of different aspects of SPI initiatives in Vietnam, where dozens of American, European, Indian, Japanese, and Chinese companies have been increasingly establishing their offshore development centres. The SPI managers of these companies can take these findings into account while designing and implementing SPI programs in their outsourcing or offshore development centres.

## Acknowledgements

We are thankful to the management of the following companies for making their staff available for this project: AZ, CT-IN, FPT, Goodland, NCS, Quantics, SDC, and VietSoftware. We are also thankful to the participants of this study. Lero is funded by Science Foundation Ireland under grant number 03/CE2/I303-1.

## 7. References

- [1] M. Chrissis, M. Konrad, and S. Shrum, CMMI Guidelines for Process Integration and Product Improvement. 2003: Addison Wesley.
- [2] B. Pitterman, Telcordia Technologies: The journey to high maturity, *IEEE Software*, 2000(July/August): pp. 89-96.
- [3] N. Ashrafi, The impact of software process improvement on quality: in theory and practice, *Information & Management*, 2003. **40**(7): pp. 677-690.
- [4] J. Jiang, et al., An exploration of the relationship between software development process maturity and project performance, *Information & Management*, 2004(41): pp. 279-288.
- [5] G. Caprihan, Managing Software Performance in the Globally Distributed Software Development Paradigm, *International Conference on Global Software Engineering*, 2006.
- [6] J. Batista and d.F. Dias, Software Process Improvement in a Very Small Team: a Case with CMM, *Software Process-Improvement and Practice*, 2000(5): pp. 243-250.
- [7] M. Niazi, D. Wilson, and D. Zowghi, Implementing Software Process Improvement Initiatives: An empirical study, *The 7th International Conference on*

*Product Focused Software Process Improvement*, LNCS, 2006.

[8] SEI, Process maturity profile of the software community, *Tech Report* Software Engineering Institute, 2002.

[9] O. Ngwenyama and P. Nielsen, A., Competing values in software process improvement: An assumption analysis of CMM from an organizational culture perspective, *IEEE Transactions on Software Engineering*, 2003. **50**: pp. 100-112.

[10] D.R. Goldenson and J.D. Herbsleb, After the appraisal: A systematic survey of Process Improvement, Its benefits, And Factors That Influence Success, *Tech Report CMU/SEI-95-TR-009*, Software Engineering Institute, USA, SEI, 1995.

[11] D. Stelzer and M. Werner, Success factors of organizational change in software process improvement, *Software process improvement and practice*, 1999. **4**(4).

[12] K. El-Emam, P. Fusaro, and B. Smith, Success factors and barriers for software process improvement. Better software practice for business benefit: Principles and experience, *IEEE Computer Society*, 1999.

[13] A. Rainer and T. Hall, Key success factors for implementing software process improvement: a maturity-based analysis, *Journal of Systems & Software*, 2002. **62**(2): pp. 71-84.

[14] K. Butler, Process lessons learned while reaching Level 4, *CrossTalk*, 1997(May).

[15] M. Diaz and J. Sligo, How Software Process Improvement helped Motorola, *IEEE software*, 1997. **14**(5): pp. 75-81.

[16] M. Niazi, D. Wilson, and D. Zowghi, Critical Success Factors for Software Process Improvement: An Empirical Study, *Software Process Improvement and Practice Journal*, 2006. **11**(2): pp. 193-211.

[17] S.R. Chidamber, An Analysis of Vietnam's ICT and Software Services Sector, *The Electronic Journal on Information Systems in Developing Countries*. <http://www.ejisd.org>, Last accessed 01 Nov 2005,, 2003: pp. 1-11.

[18] R. Terdiman and F. Karamouzis, Going Offshore to Globally Source IT Services Gartner Research, *Tech Report* 2002.

[19] S.R. Nidumolu and S.E. Goodman, Computing in India: an Asian elephant learning to dance, *Commun. ACM*, 1993. **36**(6): pp. 15-22.

[20] E. Carmel, Taxonomy of new software exporting nations,, *Electronic Journal on Information Systems in Developing Countries*, **13**, 2003.

[21] SEI, Process Maturity Profile, *Tech Report* Software Engineering Institute Carnegie Mellon University, 2006.

[22] H. Coolican, Research Methods and Statistics in Psychology. 1999: Hodder and Stoughton, London.

[23] M. Niazi, D. Wilson, and D. Zowghi, Critical Barriers for SPI Implementation: An empirical study, *IASTED International Conference on Software Engineering (SE 2004)*, 2004.

[24] M. Niazi, D. Wilson, and D. Zowghi, A Maturity Model for the Implementation of Software Process Improvement: An empirical study, *Journal of Systems and Software*, 2005. **74**(2): pp. 155-172.

[25] T. Hall, A. Rainer, and N. Baddoo, Implementing Software Process Improvement: An Empirical Study, *Software Process Improvement and Practice*, 2002(7): pp. 3-15.

[26] A. Rainer and T. Hall, Key success factors for implementing software process improvement: a maturity-based analysis, *Journal of Systems and Software*, 2002. **62**(2): pp. 71-84.

[27] M. Niazi, M. Ali-Babar, and S. Ibrahim, An Empirical Study Identifying High Perceived Value Practice of CMMI Level 2, in accepted in the 9th International Conference on Product Focused Software Process Improvement. 2008: Rome, Italy.

[28] Trewin and D, Small Business in Australia: 2001. Australian Bureau of Statistics report 1321.0, 2002.

[29] K. Butler, The economics benefits of software process improvement, *CrossTalk*, 1995(July).

[30] G. Yamamura, Software process satisfies employees, *IEEE Software*, 1999(September/October): pp. 83-85.

[31] N. Baddoo and T. Hall, De-Motivators of software process improvement: An analysis of practitioner's views, *Journal of Systems and Software*, 2003. **66**(1): pp. 23-33.

[32] N. Baddoo and T. Hall, Motivators of software process improvement: An analysis of practitioner's views, *Journal of Systems and Software*, 2002(62): pp. 85-96.

[33] S. Beecham, T. Hall, and A. Rainer, Software Process Problems in Twelve Software Companies: An Empirical Analysis, *Empirical software engineering*, 2003. **8**: pp. 7-42.