

## The Impact of Fear on the Operation of Virtual Teams

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### Abstract

*Distributed software development has become the norm for the software industry today. As a result many organizations are leveraging the expertise of their existing staff by establishing virtual teams. Here we outline the results from three independent case studies undertaken over a period of eight years. The first study considered the operation of virtual teams whose members were situated in two locations in the same country. The second investigated why U.S. and Irish team members who worked very successfully while collocated, experienced serious problems when operating in virtual teams. The third focused on virtual testing teams with members based in Ireland and Malaysia. The Irish staff had extensive experience of having projects offshored to them and were now responsible for offshoring part of their work. The results from each case study highlighted the importance and impact fear played and the consequences this had for the success of the respective strategies.*

### 1. Introduction

In the Information Technology (IT) industry today software development can be truly considered a globally sourced commodity [1]. The rationale articulated for the sustained popularity of this trend includes the advent of the Internet and the availability and utilization of effective and inexpensive global communication tools [2]. In addition one of the main commercial advantages and drivers outlined for the selection of this strategy is that organizations are gaining competitive advantage from the globalization of software development [3, 4] This is mainly ascribed

to labor arbitrage, which allows reduced development costs [5, 6]. This is facilitated by the availability in large numbers of well educated and technically competent software engineers in low cost centers in Eastern Europe, India, Latin America and the Far East [7-9]. The logic underpinning this strategy is, that these cost savings and the temporal difference between locations facilitate competitive pricing and reduce time to market thus enabling companies to compete more effectively [10, 11]. As a result organizations can therefore gain, maintain, or increase their market share in the dynamic and ever changing global economy, in which businesses operate today [1, 12].

As many organizations who have implemented a globally distributed software development strategy have discovered, due to the level of complexity involved in software development, outsourcing to other organizations or offshoring to remote divisions is not a straightforward task [5, 13, 14]. Some of the difficulties encountered include understanding requirements and the testing of systems [8] as well as communication, cultural and coordination problems [15, 16]. The primary focus of the research undertaken in the area of Global Software Development (GSD) to date has been on establishing, operating and monitoring outsourced or offshored projects and teams. While these are relevant areas, a key factor to emerge from our research which we present here is the impact that implementing a GSD strategy can have on the managers and engineers whose work is actually outsourced or offshored. Of particular importance is the considerable impact this can have on the overall success of implementing an effective distributed software development strategy.

The focus of our research has been the operation of virtual software teams with members based in the United States, Ireland, and Malaysia. The results

presented here are those which emerged from three independent case studies which were undertaken over an eight year period. Our selection of the operation of virtual teams as the basis for each investigation included their vulnerability to the full impact of all the factors which have a direct bearing on geographically distributed software development. Virtual teams were therefore considered the most relevant subjects to study when researching national and globally distributed software development. In this context our findings can be considered relevant to the wider area of GSD which includes other types of offshoring and outsourcing and not solely virtual team operation [17].

The three case studies we present here are classified under the GSD strategy headings outlined by [12]:

#### 1. Local offsite software development

Virtual team members were both part of the same organization and were dispersed between two locations one hundred and fifty miles apart in Ireland.

#### 2. Offshore / nearshore software development

Virtual team members were located in the United States and Ireland. The project was a partnership between a US based financial organization and the Irish division of a US multinational organization. The sites were geographically distant, but they were considered linguistically and culturally nearshore [18].

#### 3. Offshore software testing

Virtual team members were geographically, linguistically and culturally distant, with members in Ireland and Malaysia. Both sites were part of the same US multinational organization. The Irish division had been the recipient of offshored projects from their US based parent for the previous twenty years and they were now responsible for offshoring part of their work to Malaysia.

## 2. Research Methodologies

In both the local offsite and offshore / nearshore virtual team case studies the action research five-phase cyclical process based approach as defined by Susman and Evered [19] and Baskerville [20] were employed. Action research entails the analysis of the direct intervention of the researcher [21]. This methodology was selected as the most appropriate for both case studies as one of the authors held the position of software quality manager with the organization in which the local offsite case study was undertaken. There were similar circumstances in the second case study where one of the authors held a management role with the Irish based division of the US multinational.

The objective in both case studies was to leverage the research opportunities which this provided while maintaining the required level of objectivity of both researchers. The bounded, results based iterative approach provided by the implementation of the action research strategy provided effective results for both independent case studies.

The third case study (offshore testing) required a different approach and research methodology. When this study was undertaken both authors were fulltime researchers and were offered the opportunity to undertake extensive on site research. The objective was therefore to maximize the opportunity which this level of access provided. After due consideration it was determined that a qualitative, structured, but inductive approach was required. This resulted in the selection of a Yin [22] based embedded case study which incorporated a Strauss and Corbin grounded theory [23] approach to data gathering and analysis.

To leverage the onsite opportunity which this study provided participant observational research was undertaken. This incorporated document review, direct observation, interviews, focus groups and questionnaire completion. This necessitated one of the authors spending a period of five months on site in the organization, on a full time basis. The objective of utilizing this approach was to “*hear the voice of the respondents*” [23]. The authors’ goal was to provide the people doing the work with the opportunity to tell by their words, actions and artifacts what was actually going on. The results which emerged from the analysis of the data were triangulated with the existing research in the areas of virtual team operation, GSD, Software Process Improvement (SPI), project management practice and relevant aspects of organizational theory.

## 3. The Case Studies

Over a period of eight years the three case studies on which this research is based were independently undertaken. The only thread that linked the motivation for each study was a desire to discover what was actually going on and what factors, both positive and negative, impacted on the distributed software development strategy which was being researched. In each case once this had been achieved the objective was to determine how that information could be leveraged to improve the operation of the respective virtual teams.

Our research was undertaken in three separate organizations. One was an Irish based software company and the other two were divisions of US multinational organizations with software development operations in Ireland. Ireland has developed over the

last twenty years from a country with a relatively small software development industry [24] to what has been described in 2003 as one of the big three locations for global software development [25]. Due to economic success and increasing costs Ireland is no longer perceived as a location for low cost software development. While it continues to maintain its level of multinational investment [26] and economic growth, but the focus has shifted to research and development and more technical and high-end value related software activities. As a result software development is now being outsourced from both indigenous Irish companies and multinational organizations based in Ireland to more cost effective development locations

This development has provided us with the opportunity in the third case study to carry out research in the situation where work had previously been offshored to an organization in Ireland who were now offshoring part of their work to Malaysia. A very pertinent question when undertaking this aspect of the research was whether the experience of having been the recipients of these types of projects, would provide any specific insight or effective approaches when the same managers and staff were responsible for offshoring part of their work?

### 3.1 First Case Study - Local Offsite

The objective of the first case study was to investigate the operation and consequent failure of a local offsite [12] virtual software development team strategy. This strategy had been implemented subsequent to the takeover by a large Irish owned software organization Irish Computing Solutions (a pseudonym) of a small software company based in Dublin (the capital). The company, which had been acquired, had a proven track record in a niche software market in the financial and telecommunication sectors. Having experienced some initial problems after the acquisition these issues were promptly identified and addressed. As a result the operation was successfully managed for two years and integrated into Irish Computing Solutions. At that juncture it was decided that a new strategy would be implemented which was to expand and develop the organization's market share by the establishment of local offsite virtual development teams. Irish Computing Solutions had a software development center located 150 miles from Dublin which had lower labor cost than the capital. The objective was to leverage both locations and capitalize on the cost advantage which this strategy offered.

A group of twelve offsite engineers were selected and they were provided with basic training in the technology and process required. Two virtual teams were established and consisted of two sets of six offsite engineers who were partnered with three experienced onsite engineers. Considerable effort was put into providing the communication infrastructure, process and support for both virtual teams. A key objective of this approach was that the onsite engineers would mentor the inexperienced offsite staff and provide effective knowledge transfer. In reality this did not take place. The experience of the offsite engineers can best be summed up in the following quote: *"The onsite engineers won't tell us anything they won't even return our calls"* This took place even though a number of different management strategies were implemented to facilitate communication and cooperation between team members at both locations. Given these circumstances within a period of six months the strategy had to be abandoned due to its total failure.

The results of the research carried out in this case study identified a number of key factors, which led to the failure of the local offsite strategy. These included communication, cooperation, knowledge transfer and motivational problems. It was noted the cost advantage the offsite engineers offered was frequently highlighted by management. This was in contrast to the often mentioned requirement for the onsite engineers to be more productive and value adding to justify their higher salaries. As an onsite engineer stated *"Do you think we are just going to tell those guys [the offsite engineers] everything so they can fire us?"* In these circumstances it was not surprising to discover a significant finding was the level of fear the implementation of this strategy had generated. In particular the negative impact this had on the motivation of the onsite engineers who were directly responsible for sending the work offsite and supporting the effort.

It also became clear this directly impacted on the other factors identified. The failure of management to recognize this fact had a direct impact on the operation of the virtual teams and ultimately contributed to the overall failure of the strategy. It is relevant to note the full extent of the level of non-cooperation and the severity of the communication problems between the offsite and onsite engineers did not clearly emerge until this research was undertaken. The organization documented these findings and utilized them to help implement other distributed development projects.

### 3.2 Second Case Study - Offshore / Nearshore

The second case study focused on what was termed offshore / nearshore software development [12]. The concept of offshore / nearshore was derived from the fact that the research centered on a partnership between a US based financial organization Stock Exchange Trading Inc. and an Irish division of a US multinational company Software Future Technologies (both pseudonyms). This resulted in the establishment of virtual teams to develop and maintain bespoke financial software. Ireland though geographically offshore, is often considered near shore, because of its linguistic and cultural similarities to the US [12, 25].

Stock Exchange Trading Inc. was the senior partner in this relationship and had an on going requirement for the development and maintenance of bespoke financial software. Previously all their software development and maintenance activities were carried out in-house in the US. As a result of continued expansion the organization identified an increasing demand for software development and maintenance. They also came to the conclusion that their in-house Information Technology (IT) strategy had become too expensive.

The solution was to find an efficient alternative, which would leverage the experience of their existing IT department while maintaining the level of quality and support required at a cost effective price. Stock Exchange Trading Inc. had previously successfully outsourced their Y2K legacy renovation to an Irish based division of Software Future Technologies. The possibility of expanding this relationship was identified and explored. After extensive negotiations a four-year contract was agreed. The terms of which outlined that both companies would partner and establish virtual teams to undertake the development and maintenance of all Stock Exchange Trading's software applications.

After the initial selection of the Irish based team members, orientation and training was provided. Within a short period there was an unexpected demand, which required seventy percent of the Irish team members to spend six to twelve months working onsite in the US in Stock Exchange Trading Inc. This was an unplanned emergency strategy and arose from the need for the development of complicated bespoke software within a short timeframe following the winning of a large contract. As the virtual teams were just being established the infrastructure for their operation was not yet in place. Moving as many Irish team members as possible to work on site with their US based team counterparts on a temporary basis was the solution arrived at in these circumstances.

This proved to be a very effective strategy and both groups operated successfully while collocated within what were to eventually become their virtual teams. As an Irish software engineer stated *"We all worked so*

*well together when we were on the same team in the US"*. Once the urgent projects were completed the Irish team members returned to Ireland. At that stage the full virtual teams were established and work commenced. Initially everything seemed to be going well, but soon serious problems were encountered. The severity of these problems directly impacted productivity and resulted in increased project overruns in time and costs. Within a short period of time this threatened the partnership between both organizations and urgent action had to be taken [27, 28].

An extensive investigation commenced and it became clear that people who had worked very successfully together while collocated were now actively obstructing and blaming each other for all the problems that arose. This was a totally unexpected outcome given the level of harmony achieved in the earlier collocated projects. Research has identified distance as being a major factor impacting GSD [7]. Our findings would concur with this view. The results from the initial investigation highlighted communication, cultural and process related problems as major contributing factors. What it did not explain was why these problems should have only arisen when the virtual team members were remotely located.

We undertook further research and motivation and the level of fear experienced by Stock Exchange Trading's virtual team members were identified as a major contributing factor to the problems experienced. It emerged that while the majority of the teams were collocated in the US the American team members did not comprehend the full implications of the virtual team strategy. Once the virtual teams were established the possible impact on their day-to-day work, promotion and future employment prospects became clear. Management reinforced these negative aspects by utilizing the strategy to justify maintaining salaries at their existing levels. They also stressed the additional cost of US based staff and the need for them to be value adding to justify the extra expense. As an American software engineer stated: *"We are so sick of hearing how little those Irish guys cost. We really have to wonder have we a future in this business"*

The outcome of this approach was unmotivated individuals who feared the loss of their jobs. This manifested itself in a lack of cooperation, alienation and on occasions outright obstruction when and where the opportunity arose. This was met with a similar negative reaction from the Irish team members who did not understand why they were the recipients of such hostile treatment from people who they had previously successfully worked with. Fear and the impact it had on motivating those located in the organization from which the work was outsourced was identified as a major contributing factor to the problems experienced.

The substantial negative contribution this made to the other factors the research identified was also recognized.

Once this important issue was realized steps were taken to make it clear that there was no threat to the future of the US based IT staff as a result of working with their Irish virtual team colleagues. Indeed the partnership provided long term job security as it facilitated software maintenance and development at a competitive price and to the required level of quality by leveraging the advantages offered by both locations. In reality the only threat to job security was presented by the failure of the virtual team strategy. If that happened the only viable alternative was to outsource the whole operation to Eastern Europe, the Far East or Latin America. The recognition of this along with the introduction of a comprehensive communication policy, cultural training, upskilling and inclusive approach to process improvement led to the establishment of a productive working environment between locations [27].

This facilitated the successful completion of the contract. While it was agreed by both parties that the virtual team strategy had eventually operated successfully, the contract was not renewed with the Irish based division of Software Future Technologies. In the renegotiations cost proved to be the deciding factor. As outlined earlier Ireland is no longer a low cost location therefore the Irish based organization was unable to compete on price and the contract went to India. It is relevant to note that Stock Exchange Trading Inc. continued to successfully utilize the modified virtual team strategy which this research made a substantial contribution in developing, with its new outsourcing partner.

### 3.3 Third Case Study - Offshore Software Testing

The third case study focused on offshore virtual team software testing and was undertaken in the Irish division of Computing World International (a pseudonym) a large US multinational operating in Ireland for over twenty years. The Irish based operation had been very successful over that period and had expanded considerably. A large percentage of the work undertaken was in offshored projects from their US parent, therefore, the Irish staff and management were very familiar with having projects offshored to them

Two years prior to undertaking this research the organization's corporate strategy changed. At that time they initiated a policy of establishing virtual testing teams with members based in Ireland and

Malaysia. The objective of undertaking this strategy was to leverage the technical ability of the Irish based staff with the competitive salary levels of their Malaysian engineers. When this research commenced four virtual testing teams were in operation within the Irish based division. Some teams were established for over a year and a half while others had only been in operation for a number of months. An additional and relevant aspect of this case study was to determine if the experience of the recipients of numerous offshored projects would provide any insight or effective approaches when the same individuals were responsible for offshoring part of their work.

This study centered on two embedded units of analysis. One was a virtual testing team with members located in Ireland and Malaysia which had been in operation for a period of eighteen months. The second was a virtual team with a similar makeup, but had been established for just over six months. Each team specialized in testing specific software for different technologies. The implementation of a Yin [22] based case study approach allowed the preparation and structures to be put in place to maximize the opportunity which the high level of onsite access provided. While an inductive sophisticated grounded theory [23] based data collection and analysis process facilitated the identification and emergence of the relevant factors and issues which directly impacted on the activities of the management and staff of both virtual teams.

It emerged from our research that the Irish based team members did not want to directly communicate or have any direct personal contact with their remote colleagues. Even though they had numerous communication tools available they refused to use them and relied excessively on the use of e-mail. As a project manager stated: *"I tell them pick up the telephone and call their Malaysian colleagues, they just won't do it."* They were also expected to mentor and provide training to their remote colleagues. This was despite the limited opportunity for synchronous communication between locations and the fact that the Irish based team members were reluctant to share their knowledge. As an Irish based engineer candidly stated: *"I am not going to tell them [their Malaysian colleagues] everything and let them take my job. I am going to hold information back."* This was a significant and serious statement and could have had serious repercussions for the individual involved, but it articulated a commonly held view which our research highlighted.

This all took place in the context of the Irish based management regularly reinforcing the fact that Malaysian engineers were two fifths the cost of a comparable engineer located in Ireland. As they were

often heard to say to their staff: *“An engineer is two fifths the cost in Malaysia compared to here [Ireland]. Therefore, you must be more value adding”*. This practice was being utilized as a method for motivating staff and as a mechanism for trying to increase productivity. The reality was it was totally counterproductive and had the opposite effect.

Corporate management only made the situation worse on their visits to the Irish operation by reinforcing this message. An Irish based engineer stated: *“They [corporate management] have always said the Irish operation was a centre of excellence. ‘The work you are doing here is brilliant’. The last two people that have been over have not said that. They said ‘Who knows? I can’t tell you, if it is going to be cheaper to do things elsewhere then that is something we are always going to have to look at’.*” The message was clear to the Irish based staff. Up to the implementation of the virtual team strategy the future of the Irish operation was secure. After its implementation its future was uncertain.

While a number of project management related issues needed to be addressed [16], it was clear, that fear was a major problem and it was an issue that the local project managers felt powerless to tackle. As one project manager stated *“I am not too sure as an organization we do a very good job of doing that [addressing the fears of jobs being offshored] ... sometimes you need it at the higher level to address those types of concerns.”* What was of interest to note in this context was the Irish management continued to reinforce what can be termed the cost and productivity mantras.

The outcome of this situation was that the Irish based staff were genuinely fearful for the future of their jobs. Cost was an issue which they felt they had no control over and that they were powerless to address. In 2004, when the on site aspect of the research was undertaken Ireland was the second most expensive country in the European Union for consumer goods and services [29]. As a team member stated which summed up the views of a large number of the Irish based staff: *“The Euro now is killing us”*. This sense of helplessness manifested itself in a large number of Irish based staff who were fearful, demotivated, uncommunicative and when and where possible they did not want to cooperate with their Malaysian colleagues.

The results produced by our research indicated that previous experience of having work offshored to the Irish based management and staff had no positive bearing on how they offshored their work in these circumstances. In fact they reacted in exactly the same manner as those who were responsible for offshoring work to them. The only tangible benefit that could be

identified from the experience was that it allowed some of those interviewed to understand why their US based colleagues who were responsible for offshoring projects to them had been so rude and unhelpful in the past. As an Irish engineer stated: *“but I just think maybe they [his US based colleagues] have lost a lot of jobs. I can now understand why they would feel so badly treated.”*

Given the circumstances of the situation outlined it was not surprising the long term results from the implementation of the virtual team strategy were very poor. The productivity levels achieved were low and delivery dates were only met after considerable amounts of overtime were worked. The projects ran over budget and the quality of the products tested and released had very high density levels of post delivery faults. As a result in one case the organization replaced the product completely by recommending the purchase of a third party application to their customers. Eventually the virtual team strategy was abandoned and the organization reverted to collocated team testing. The outcome of this investigation was presented and discussed in detail with senior management. The salient points were validated and noted, the objective was that the results from this study would be leveraged by the organization as a whole and utilized to amend their existing and future GSD offshoring and outsourcing strategies.

A totally unexpected outcome to emerge from this study was the results generated proved to be very similar to those identified in the previous two case studies [28]. This was despite the fact that this research was carried out in a very different organization than those previously investigated. The problems which were identified were also much more severe [30]. The authors recognized the reason for this difference in severity was due to the extent of the geographical, temporal, cultural, and linguistic differences of the participants. The factors we identified included motivation, lack of trust, teamness communication, coordination, culture, process and project management related issues [16]. While each of these factors had an important impact in their own right, it was recognized that fear had a substantial negative influence on all of them in a number of different ways. This had serious repercussions for the operation of both teams and ultimately on the success of their respective projects.

It is important to state when the data emerged from this study numerous alternative explanations and factors were considered. These were extensively explored, but the inductive nature of our study clearly highlighted the importance and negative impact fear played.

## 4. Lessons Learned

All the factors we identified in these three very different case studies were relevant, but the level of fear experienced and the impact this had on the motivation of those individuals whose work was offshored or outsourced proved considerable. This was identified as having a direct impact on the overall success of the implementation of all the distributed strategies researched. While the fear of losing jobs on the part of those offshoring and outsourcing their work has been mentioned in the literature [15, 31], the full implications that fear can have on the operation of globally distributed teams has not been given the level of importance that the results from our research indicates it warrants. Specifically, the ongoing level of negative impact it can have with regard to motivation and the desire to work with, trust, cooperate, communicate and share knowledge with remote colleagues in a GSD setting is of particular relevance. As the second case study highlighted even were people have successfully worked together for up to year in a collocated situation, once a virtual team strategy was fully implemented these problems soon came to the fore.

It is important to state that the objectives of the organizations in the three case studies outlined here were not to downsize and migrate their software development or testing operations to low cost locations. Rather it was to utilize the technical ability and experience of their existing staff and leverage it with the cost effective opportunities that utilizing remote centers and personnel provided. What the organizations held in common was a belief that this strategy could be used as a method of maintaining cost at their current levels for existing staff at the outsourcing and offshoring locations. They also believed it could be used as a motivating factor to increase their existing staff's productivity. The mantras "*Engineers are half (or two fifths) the cost in the other location*" and "*Existing employees must be more productive and value adding to justify their higher salary levels*" were frequently expressed. In each case implicit in these statements from the onsite staff's prospective was the threat that the whole operation could be offshored, or outsourced given the cost advantage offered. As stated this was not the long-term strategy of any of the organizations researched.

The implications of implementing this approach were the management of these organizations only succeeded in creating a level of fear, which proved counterproductive. In the third case study the company recognized there could be negative repercussions to the

extension of their offshoring strategy. In these circumstances they made an ex gratia payment to their existing Irish based staff as compensation for offshoring part of their work. This had the effect of adding to the fears of their existing employees, as they believed if they were being compensated they were going to lose something of value. The organization's management who continued to employ their cost and productivity mantras reinforced this belief. It was clear from the results of our three case studies instead of motivating staff this strategy had the exact opposite effect.

Our research identified fear had a negative influence on motivation which directly impacted communication, cooperation, trust, team building and knowledge transfer. Motivation is a key constituent of any successful operation as it is the driving force in the achievement of goals and objectives in the team setting. This is particularly pertinent for the successful implementation of a distributed software development or testing strategy. Our research highlighted the negative impact fear had on the motivation of those whose work was being sent offsite, outsourced or offshored. In the three unrelated case studies this resulted in low morale, hostility toward remote colleagues which manifested itself in uncooperative and on occasions obstructive and aggressive behavior.

### 4.1 Communication

Effective communication is an essential element for successful globally distributed software development and testing [10, 13, 32]. Motivation directly impacts on the level, content, effectiveness and use of communication. Individuals have to be motivated to use the tools provided to communicate. When they are used, the level of communication which takes place as a result must be effective. In the first case study (local offsite) the engineers' part of whose work was to be sent offsite were only motivated to communicate with their offsite colleagues in a very limited manner. As a result communication was kept to a minimum, telephone calls were not returned, on occasions e-mails were not responded to and queries remained unanswered. When direct communication took place the discourse was curt and on occasions aggressive. This resulted in inexperienced team members in an offsite location who lacked the communication, support and knowledge transfer they so badly needed to carry out their projects successfully. Our research identified fear and its impact on the motivation of those, part of whose work was being sent offsite as a key factor in the overall failure of this strategy.

In the second case study (offshore / nearshore), communication was used as a weapon with which to attack remote colleagues. This was primarily achieved thru the misuse of e-mail. This was initiated by the US based team members using e-mail to highlight any minor problems that arose with colleagues in Ireland [27]. The Irish staff responded by adopting a similar negative approach. As a result minor issues, which presented team members at the other location in a negative light, were regularly copied to middle and senior management by staff at both sites. This resulted in issues that should have been resolved within the respective teams being escalated out of proportion. This directly led to the alienation of staff and middle management at both locations on geographical lines. The result was a breakdown in cross-site relationships and effective communication. This very nearly resulted in the collapse of the offshore / nearshore strategy. It is of particular relevance to note these problems arose despite the fact the individuals involved had worked successfully together for over a year when collocated.

In the third case study (offshore testing) the Irish based team members would normally only contact their remote colleagues using e-mail. They were actively encouraged to use the telephone and instant messenger, but they consistently made excuses and refused to do so. The reasons stated for their refusal were they did not know if they were contacting a man or a woman or what order their remote colleagues first and surnames were in. These issues arose due to their colleagues being located in Malaysia and the cultural differences between sites, which resulted. The question why this should prevent direct contact was not satisfactorily explained. Even though, this particular question was asked on numerous occasions. When the use of the organization's intranet was suggested as a location where team member's pictures, names and correct form of address from both sites could be displayed, the Irish staff rejected this suggestion. Clearly they were not motivated to use the range of effective tools provided. When they did communicate it emerged there was a reluctance to provide information to their remote colleagues due to the level of fear they felt at the possibility of losing their jobs to them.

The use of similar cost and productivity mantras as those outlined in the other case studies were identified as key elements responsible for generating and maintaining the level of fear experienced by the Irish based team members. The negative impact fear had on motivation was identified as a key factor which directly contributed to the communication problems which were experienced. The reality was as a result staff were motivated not to fully utilize the range of communication tools which were provided. It clearly

emerged that fear was a direct barrier to effective communication between sites.

## 4.2 Trust, Cooperation, Team Building and Knowledge Transfer

It is recognized that essential elements required for successful distributed software development include the establishment of trust, successful team building and effective cooperation and knowledge transfer between sites [33]. This point is articulated in the following statement "*Trust is pivotal in a global virtual team to reduce the high level of uncertainty endemic to the global and technologically based environment*" [34]. The results from the three case studies we have outlined in this paper clearly demonstrate how fear and its influence on motivation directly impacted negatively on trust, team building cooperation and knowledge transfer.

It is very difficult for individuals and groups to trust and build relationships with people who they fear are ultimately going to take their jobs [35]. Even where good relationships existed as in the second case study (offshore / nearshore) they soon broke down under the pressure of this type of fear. The very structure of distributed development facilitates the identification of remote colleagues as a common enemy. Our research confirmed that in the three case studies a clear "*them and us*" culture existed [36]. The reality was personal relationships between sites did not exist or had seriously broken down. Fear and lack of trust negatively impacted on the building of effective cross-site teams. This resulted in clear examples of not wanting to cooperate and share knowledge with remote colleagues.

## 5. Conclusion

As we have outlined distributed software development is a reality in the software industry today and its popularity continues to increase. Some organizations are utilizing it to downsize by completely outsourcing or offshoring their software development. Others are leveraging the technical knowledge and experience of their existing staff with the cost benefits provided by remote low cost centers. In this context a popular strategy is the establishment and operation of virtual teams. Our research has highlighted fear and its impact on motivation, trust, teamness, communication and knowledge transfer as having a direct bearing on the success of implementing this approach. We would stress these are not the only factors that are involved. That stated we believe to date fear and its potential negative impact on the operation of globally distributed



software development projects has not received the level of attention that this research indicates it warrants.

The first step in tackling this issue is the recognition that this is a factor which needs to be effectively addressed. In this context there is a requirement for senior management to understand the problems and issues associated with implementing a GSD strategy. This includes the need for the risks associated with fear in this context to be appreciated, including the negative impact it can have on the overall success of GSD projects. Team based software development is not only a technical activity. There are important human and social elements which need to be recognized, considered and specifically addressed. Once this recognition has been achieved effective communication is key. This includes the importance of understanding and clearly articulating the advantages of implementing a GSD strategy for all the participants involved. Fear and its implications should be openly discussed and addressed. The use of productivity and cost mantras need to be avoided as this research has highlighted they are totally counter productive. The importance of positive motivation needs to be understood and leveraged by effective and proactive management.

There is a requirement for procedures to be put in place, which facilitate the establishment and operation of cohesive teams. Training on culture and how to effectively communicate with remote colleagues needs to be provided. Where possible the upskilling of existing staff should be undertaken. This is a clear and tangible indication of the outsourcing or offshoring organization's commitment to their existing staff. This approach was utilized very successfully to help address some of the problems which were identified in the second case study.

Effective infrastructure which includes a comprehensive communication procedure should be implemented and monitored to insure it is utilized. Success needs to be based on joint (or multi) location performance which facilitates the development and achievement of common goals, objectives and rewards across sites. It is essential to recognize the fear of jobs being outsourced or offshored can by its very nature undermine motivation, trust, teamness, communication and knowledge transfer. If this is not addressed it has the potential to directly hinder and prevent the successful accomplishment of geographically distributed team base software development.

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