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## Lessons in global software development – local to global transition within a regulated environment

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# Lessons in Global Software Development – Local to Global Transition within a Regulated Environment

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## **Abstract**

In this paper we use an established framework as a focusing tool to provide a summary of the first author's experiences of GSD in an "Information System" (IS) team of a global supply-chain-management company operating within a regulated environment. While the transition to a GSD configuration was transformational, and introduced an exciting multi-cultural working environment, we discuss several problematic areas and the processes which were employed to successfully resolve them. Some focus is also given to the economic recession, how that has shaped the GSD configuration within the company, and again the processes implemented to meet the changing team dynamics.

## **Keywords**

Global Software Development, Global Transition, Regulated Environment

## 1 Introduction

In this report we carry out a reflective analysis of one of the author's industrial experiences in Global Software Development (GSD) over an 11 year timeframe in company MyOrg. There are a multitude of characteristics of GSD but for the purpose of this report we are using the broad definition "any software development lifecycle activity" [1]. This covers all activities such as writing a requirements document, developing a piece of software, through to code deployment in a live environment and problem resolution in a production setting. We would also categorise the interaction with the business teams as being a prominent activity in this.

**Table 1: An overview of the framework of issues in DD [1]**

| Processes     | Dimension  |  |  |
|---------------|--|--|--|
|               | Temporal Distance  | Geographical Distance  | Socio-Cultural Distance  |
| Communication | Reduced opportunities for synchronous communication, introducing delayed feedback.<br>Improved record of communications.                 | Potential for closer proximity to market, and utilisation of remote skilled workforces.<br>Increased cost and logistics of holding face to face meetings                               | Potential for stimulating innovation and sharing best practice, but also for misunderstandings.  |
| Coordination  | With appropriate division of work, coordination needs can be minimised. However, coordination costs typically increase with distance.    | Increase in size and skills of labour pool can offer more flexible coordination planning.<br>Reduced informal contact can lead to reduced trust and a lack of critical task awareness. | Potential for learning and access to richer skill set.<br>Inconsistency in work practices can impinge on effective coordination, as can reduced cooperation through misunderstandings. |
| Control       | Time zone effectiveness can be utilised for gaining efficient 24x7 working.<br>Management of project artefacts may be subject to delays. | Difficult to convey vision and strategy. Communication channels often leave an audit trail, but can be threatened at key times.  | Perceived threat from training low-cost 'rivals'. Different perceptions of authority/hierarchy can undermine morale. Managers must adapt to local regulations.                         |

While this report is inspired by the work of Lane & Ågerfalk [2], there are some significant differences which, in our opinion, are worthwhile reporting:

1. **Context** - The focus here is on projects involving internal Information Systems (IS) teams whereas Lane & Ågerfalk are specifically dealing with "Packaged" teams. In fact they suggest that "it is likely that application of the GSD framework to IS teams may reveal further insights".
2. **Regulation** - Because MyOrg is a publicly trading US company (NASDAQ listing), it is required to comply with the Sarbanes-Oxley Act of 2002 (SOX) which governs the processes for financial reporting, and therefore the systems and applications which contain and could affect the financial data. This as we report had implications on the software development processes as many of its centres world-wide<sup>1</sup> had to undergo annual audits.
3. **Transition** - Our span of review covers a slightly longer time span (11 years) and similar to [3] includes the progression from local site specific IT groups to:
  - a. co-located and distributed global development teams operating in parallel
  - b. a shared services IT model
4. **External Contractors** - The use of onsite and remote contractors at MyOrg depending on the project.
5. **Recession** - Experiences as a consequence of a global economic downturn and how that affected the GSD activities.

<sup>1</sup> Only those sites whose turnover exceeded a certain limit were deemed to be in scope for SOX audit.

GSD, has been examined from many viewpoints [1],[4],[5],[6],[7],[8], and cognisant of the critic by [9] of the usefulness of experience reports (albeit for Agile GSD), we believe that this report offers some unique perspectives into the complexities of GSD and implementation and modification of processes specifically for GSD.

## 2 The Company

MyOrg is a US multinational and is a leader in global supply chain business process management with a focus on the high technology and communications industries. Originally organised as a collection of around 30 international sites in places such as Mexico, United States, Holland, Ireland, China, Japan among others, each performed similar activities but with very different operating procedures, processes and supporting systems. From an Information Technology (IT) point of view, each site originally had its own self sustaining IT department complete with software engineers, technical and application support personnel. This resulted in inefficiencies including duplication of effort, to non-use of best practices and implementation of systems and applications which do not easily support inter-site business processes. Such IT organisation is an anathema to building consistent and reproducible business processes across a global organisation.

Through a series of transformations, over an 11 year period, a true shared services IT model was introduced which included a globally distributed software development team with members located in the United States, Europe and Asia managed from an Irish office. This necessitated a shift in mind-set for the business teams who had to adjust and learn to interact with the IT organisation from the perspective of a true customer as opposed to seeing IT as a readily available extension of their own resources. A form of constructive engagement [4] was utilised in order to instil a new culture necessary to make the globalised and standardised IS function effective.

One of the authors of this paper has a unique perspective on the history of this transformation, having joined the organisation at the start, being an integral part of all stages and finally as the Global Manager of the software development and support groups.

### 2.1 PACKAGED versus IS Teams

Depending on the context within which a development team operates, they can be referred to as Packaged or IS teams. Packaged teams normally produce an end product. This product is packaged up and sold commercially. IS teams are generally considered to be working internally to support corporate objectives. Carmel & Sawyer [10] state the differences between IS and Packaged software teams include cost pressures versus time-to-market pressures, and bureaucratic versus entrepreneurial cultural milieus. While in general we would agree with these distinctions, software development within MyOrg could be classified as residing somewhere between the two definitions. They believe that “... *packaged software firms function in an environment of intense time-to-market pressure relative to IS development efforts*”. However, MyOrg was expected to be operational within the timelines governed by the customer who in turn often operates to their own specific market-driven product release schedules or seasonal consumer activities. From a globalisation perspective, in order to achieve integration, some level of standardisation is required, but, according to [4], the effort for standardisation of packaged teams pales in comparison to the scale of obstacles that a global IS function has to deal with.

The cost and resource pressures which [10] note as being typical of an IS support function were often not relevant in MyOrg. When developing software as part of a new piece of business (directly related to a customer's product), the cost of that development is factored into the outsource contract (either directly or indirectly). The IS function then has the flexibility to look externally for resources and are consequently relatively free of the cost burden. This results in the team becoming more akin to packaged teams developing COTS applications [11].

## 2.2 Regulation

In the United States any publicly trading US company must adhere to relatively new financial accounting and reporting standards as specified in the Sarbanes-Oxley Act of 2002 (SOX)<sup>2</sup>. While the focus of SOX is primarily financial accounting and reporting practices, section 404 of the act stipulates that each company must appoint an internal auditor and perform an annual assessment of the company's controls. A critical element of those controls refers to the ITGCs (Information Technology General Controls) which are intended to ensure Financial data is stored securely, that only the relevant people have access to certain systems and functionality and also that any software/modifications developed which could affect the financial data are developed within a robust and documented software development process. Therefore it was imperative that, within a GSD environment management were confident that each developer, regardless of location, adhered to the internal processes which are aligned with the expectations of SOX.

## 2.3 Transition: From Self-Sufficient to Shared Services

A key learning from this time period has been the effect on the different business units of moving to a shared-services model of IS development, and this had an impact on how the IS team worked within the global environment. Because MyOrg relied on winning outsource contracts from other companies, what evolved were sometimes similar business processes which were necessarily treated separately in order to satisfy customers' security and reporting requirements. This resulted in small internal business groups each with demands on the same IT resources but each with a customer in the background pushing for deliverables. When this occurred in a global shared-services model with distributed software developers, some issues arose. It became much more difficult to triage the development projects because the demands for resources were coming from multiple sites in different geographical locations with different and often unconnected management structures. From studying the literature on GSD we believe that this aspect has not been fully investigated and warrants further investigation possibly in conjunction with the business research community.

### 2.3.1 External Contract Staff

MyOrg employed external contractors. However, this resulted in contractors, sometimes in different time-zones, having the required technical ability, but no knowledge of the business processes, user-base or bigger architectural picture. Therefore, they had little hope of giving accurate project estimates. They were also unfamiliar with internal procedures regarding documentation, source control and testing requirements. One particular case ended up costing double the original estimate due to the slow pace of the deliver-test-feedback cycle. Combining this with an unconscious lack of trust due to their remoteness led to a huge overhead in management time and investment shadowing their work. The best method we found to protect against such overrunning development costs was to agree a fixed price up front. We need to remember that contractors are business people who rely on their ability and specialised knowledge to earn a living. It is precisely for this knowledge that we hire them and it would be naive to think that they are not aware of and utilise this information asymmetry to their advantage [12].

## 3 Some Lessons

Taking the differences discussed into account, we have analysed the experiences within MyOrg using the framework presented in Table 1. Below we describe some of those challenges in more detail and the processes implemented to address them.

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<sup>2</sup> <http://www.sec.gov/about/laws.shtml#sox2002>

### 3.1 Communication (but more than just with each other!)

Flexible and ad-hoc communication [13] was something that was important within the co-located configuration. When team members had coffee break, unplanned very useful exchanges occurred. This type of chance exchange rarely happened between people physically separated. While information exchanged can be quite trivial it can translate to savings. We noted an example: when discussing a compilation issue which another developer also encountered and which could have taken several hours to resolve, the issue was resolved in the informal discussion.

#### *Remediation:*

To resolve the lack of chance exchange problem following GSD implementation, we implemented a process whereby bi-weekly informal conference calls were setup where all the software developers would give an update on their current assignments and discuss any items they wished to bring up. This was particularly useful for those developers who worked on their own and who would have had limited contact with the rest of the group. Weekly conference calls were also established with a more application-support focus with the aim of strengthening team links and fostering collaboration.

### 3.2 Coordination

#### 3.2.1 Responsibilities

There is no substitute for experience. An interesting point is that the lack of “*Global Project Experience*” [14] (experience of working in a global team context) was something that was very observable in the early stages of moving to the global configuration. In MyOrg, a sort of “out of sight out of mind” attitude was prevalent simply by virtue of having operated as stand-alone departments for so long. This was exacerbated by the fact that MyOrg had multiple core-system instances around the world. For example, when a multi-site project was going live the configuration of the systems would have to be set-up in advance. On several occasions, last minute tweaks to the configurations were made in one site but not to the others, “*I never thought to tell the other sites*” was a common response.

#### *Remediation:*

This is something which, with persistence, gets better over time but which also required the implementation of a global project management process with tight coordination across the different sites. An important lesson learned was to delegate responsibility for managing important sub-tasks which would affect multiple instances.

#### 3.2.2 Temporal Dispersion

Another difficulty experienced was the effect of temporal dispersion of GSD. It was very evident and something which really does require a big effort to circumvent. People like to operate within a structured timeframe, and time differences caused some problems, as it put pressure on the developers (and others) to work outside their comfort zone. As an IS support function, the IS team is obliged to support the local sites during their working times. When you are dealing with all 3 global geographical regions (US, EU and APAC<sup>3</sup>) it becomes problematic, especially when the US personnel need to work with people in APAC. In MyOrg's case this led to three main outcomes:

1. Interaction between teams across the Atlantic got focused towards the end of the European working day and the start of the US day and thus skewed the rhythm of both teams
2. Interaction between Europe and APAC got focussed at the start of the European day and the end of the APAC day
3. Pressure on the US and APAC teams to work unsociable hours in order to overlap
4. Longer resolution times to issues

#### *Remediation:*

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<sup>3</sup> US: United States of America; EU: European Union; APAC: Asia-Pacific

Temporal issues are extremely difficult to eradicate completely, but implementing processes around working arrangements can assist. For example, at times European developers worked the equivalent of US times to keep a project on track. Due to an asymmetry in knowledge and skills it took a long time before a more “follow the sun” approach could be implemented. Issue resolution was on average longer when dealing in the distributed environment but specific escalation paths were introduced in order to expedite special cases. Educating the internal business community was also required and performed by means of global email communications and site visits. It is also worth noting that having management located in Ireland (a ‘Bridge’) did help alleviate some of the issues since normal working days did overlap between APAC and Ireland and also the US and Ireland [15].

### 3.2.3 Inter-Site Contact

A source of much frustration for the developers was getting in touch with someone at a remote site. This was typically to help with things like clarifying user requirements, user-testing functionality or carrying out a local installation. This was exacerbated when a requesting party left the company at some point within the project lifecycle – it was often difficult to find a replacement who was knowledgeable enough to take up the project and ensure adequate resources to complete it.

#### *Remediation:*

The GSD project management process (described below) ensured that each site appointed a representative who could help get such situations resolved swiftly.

## 3.3 Control

One of the most problematic areas experienced was around the scheduling and prioritisation of projects. As we said before, operating as a shared service means that the group gets project requests from all corners of the organisation. In a global context that means that your internal customers can be located anywhere and also that different business managers and indeed regional presidents are vying with each other for development resources. Many times this led to conflict and internal management escalations in order to secure resources, sometimes external.

#### *Remediation:*

A project review board (PRB) was instigated which consisted of a representative from each site who would attend a weekly conference call and help set the priorities of development projects. It is important to say that these representatives had to have the authority to speak on behalf of their sites which is why it was crucial that the respective General Manager appointed them to the PRB. Overall this worked quite well but it still proved very difficult to get consensus on prioritisation when multiple sites were under pressure to deliver projects within the same timelines.

### 3.3.1 Code Control

SOX controls are quite strict when it comes to the control of source code and especially the access to deploy code to a system which could impact the financial statements. This ‘segregation of duties’ requirement meant that, for example, a developer was not allowed to have access to a ‘live’ system. As a result only a very limited number of people were allowed to deploy production code or even have administrator access to production systems. For traceability purposes, each code release had to be recorded and available for inspection during audits.

In a GSD context these points were problematic on a number of fronts. Below are some of them and the resolutions implemented:

1. There were certain skills required to check a code release for deployment and keep track of what was deployed in the context of the wider systems and then verify the deployment was successful. In some instances this skill was only available from senior developers.

*Remediation:*

DBAs (Database administrators) were trained up on the specialised deployment and trace techniques. However in one case, even though the DBA physically carried out the task, it still had to be under the supervision of a senior developer.

2. When second level support was required from a developer, they typically would have used a high level access login to troubleshoot the issue. This login gave them too many privileges on the system (contrary to the SOX guidelines).

*Remediation:*

When required, the application support group (who were allowed to have this level of access), would log the developer in with high level access and record the fact on a report which was archived. This did introduce delays into some issue resolution but this trade off was necessary to satisfy the SOX auditors.

3. The actual code which was being deployed had to be archived with the other project documents and signed documentation had to accompany it. This was then audited on an annual basis. This was problematic for remote developers who had to spend a lot of time getting forms filled and signatures from the relevant parties. This was also a new practice for many in the business community who were used to dealing with onsite developers where informal consent was common practice.

*Remediation:*

As a solution, the process we implemented ensured that we provided a shared network storage area (sharepoint) where all developers could deposit their project documents and from where all audit documentation could easily be retrieved. To ease the effort in obtaining signoffs, the business groups were educated in the requirements of SOX and therefore they understood the necessity and were much more compliant as a result.

### 3.4 Cost

We believe cost needs to be discussed in the context of regulation and GSD. The cynical amongst us might suggest that the financial consultancy fraternity was behind the implementation of the SOX regulations. A large amount of effort and cost went into developing, coordinating, controlling and auditing the internal practices of MyOrg to meet the SOX requirements. The direct external cost of hiring consultants for dry-run auditing followed by the official auditors has been significant. Typically this might take 1-2 weeks of an auditing company's time. In our case costs increased dramatically as each of the larger sites had to be audited separately.

*Remediation:*

We introduced a process which established the position of a global compliance officer. MyOrg fine tuned the internal controls around the software development and support activities so as to only satisfy what was actually required by the SOX regulations. What had preceded this was that the *auditors* decided what they wanted to see and therefore how we had to operate. By reducing this to the exact SOX requirements and making all the documentation available on a central repository, MyOrg reduced the time the auditors needed to spend on site and also the number of controls which failed the tests. This single set of 'Global' controls was rolled out to all developers and support members and proved instrumental in moving towards a cross-regional IT function. However, one person spent a substantial amount of time ensuring that all team members, especially external contractors, were following the processes and maintaining the necessary documentation.

### 3.5 Economic Recession and the race to the bottom?

Thomas Friedman [16] wrote about how the technological advances of the 21<sup>st</sup> century had aided in 'flattening' the economic playing field of global business. For example, the ability of companies to join forces across the globe to create global supply chains that offer efficiencies, economies of scale and

reduced operating costs. Even small companies can now compete for contracts which heretofore were only available to larger corporations. But the literature shows us that it sometimes is not so straight forward and the costs savings that are headlined in such outsourcing arrangements are often not reflective of the true costs incurred [17], [18].

When the global economic downturn started to affect MyOrg (2007/2008), international travel was reduced. There were many more areas which were affected such as equipment purchases, salaries, bonuses and support agreements, but we examine travel as a representative example. This resulted in the removal of regular trips to the central European facility for crucial face-to-face project meetings with the business managers. Even more so, these trips supported the process of bringing the distributed IT teams together by reinforcing the direction and structure being put in place. This had some negative consequences.

Due to the decreased management visibility "on the ground" for both team members and local business managers, we instigated processes whereby email communication, especially to the business managers, was intentionally increased, particularly in terms of project scheduling, status reports, initiatives and organisational changes. While there was less opportunity for team members to speak freely to their manager on a face-to-face basis we replaced this with much more frequent (formal and informal) phone conversations and instant messaging. We also appointed of a local (on-site) supervisor to act as a direct management point of contact. However, the reduction of human-to-human interaction, particularly between employee and manager, is a much underestimated and underexplored consequence of GSD in general.

Further, during the annual SOX audit time, IT management was unable to meet with the auditors, therefore audit interviews were performed over the phone. Local group members were appointed as contact points for the auditors and all evidence that the auditors requested was readily available electronically in a centralised location.

As the global recession set-in for a protracted period, senior management decided to implement an offshore outsource software development and support arrangement. An India based outsource provider was selected and a plan put in place to transition activities to them. Existing US and European based employees lost their jobs. It is not our intention to go into the already well published issues this can cause [15], [19], [20], [21] or how risky this can be to a company [22]. Instead, we feel what is worth disseminating is that quite a different version of the original outsource plan actually got implemented:

- More employees were retained than originally expected, mainly due to the gradual acceptance that it was much more difficult to find the exact skill-set required and also that the "tribal" knowledge that these people had built up over the years was quite substantial and probably impossible to transfer
- The transition time was severely underestimated partly due to difficulties in performing the knowledge transfer

An exercise which would be very insightful would be to attempt to calculate the actual cost of the outsourcing plan and what the planned versus actual annual savings turn out to be. The literature is well stocked with research and case studies on this [17], [18], [23] so an investigation into the hidden costs in this case would be enlightening.

## 4 Summary

The lessons and processes introduced and discussed in section 3 have been summarised into three main categories, Distribution, Regulation, and Recession (see Table 2).

Table 2: Issues and Processes introduced to resolve the problems

| CONTEXT      | ISSUE                      | PROCESS  |
|--------------|----------------------------|--|
| Distribution | Loss of ad-hoc "chatting"  | Bi-weekly informal calls                                 |
|              | "Out-of-sight out-of-mind" | Assign a global owner for specific tasks                 |
|              |                            | Persistence  |
|              | Time-Zone Issues           | Shift working days as appropriate                        |
|              |                            | Define Global Escallation Paths                          |
|              |                            | Educate the Business teams                               |
|              | Scheduling Conflicts       | Make use of a 'Bridge'                                   |
|              | On the ground support      | Create a Global Project Review Board (PRB)               |
|              |                            | Local PRB Representative                                 |
| Regulation   | Segregation of Duties      | Train up DBAs to perform deployments                     |
|              |                            | Coordinate with app support for 2nd level support access |
|              | Auditability               | Centralised repository (sharepoint)                      |
|              |                            | Educate the Business teams                               |
|              | Cost                       | Precise mapping of SOX controls to internal controls     |
|              |                            | A common 'Global' set of controls                        |
|              |                            | Centralised repository (sharepoint)                      |
| Recession    | Travel Ban                 |  |
|              | -Less mgmt visibility      | Consiously do more information pushing                   |
|              | -Loss of team face-to-face | Consiously do more phone calls and instant messaging     |
|              |                            | Appoint a local management contact                       |
|              | -Audit difficulties        | Interviews via conference calls                          |
|              |                            | Appoint local IT staff as contact points                 |
|              |                            | Centralised repository (sharepoint)                      |

## 5 Conclusion

From reviewing our experiences we have shown how GSD introduces an assortment of interpersonal, procedural and organisational challenges. In particular we have shown, that within IS teams, there are different issues that emerge between the IT team and their internal customers. We found that while the existing literature concentrates a lot on the temporal aspects of GSD and how the team members and team management are affected, little focus has been given to how it affects the internal business community and the boundary/interaction with the IT team. We believe that further study is warranted here with a view to establishing an appropriate interface between the two groups in a GSD setting.

We have shown that regulation can be particularly problematic within a GSD setting, and time should be invested in developing and rolling out a common but minimised set of processes globally. The case presented has also been affected by the current recession and decisions to cut back on cost made it more difficult to carry out those activities which researchers have noted help alleviate the very issues faced by GSD teams. We feel that the cost factor has not been given enough attention with respect to how it influences strategies for GSD and the consequent effects on the wider organisation.

MyOrg subsequently undertook to outsource the software development and application support activities to a third party primarily located in India. At a further point in time we think it will warrant a revisit to analyse how this new dimension, that of organisational boundaries [14], has affected the organisation, what issues arose and how they were addressed over time.

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## **8 Author CVs**

### **Oisín Cawley**

Oisín Cawley is a doctoral researcher within Lero – the Irish Software Engineering Research Centre in the Department of Computer Science and Information Systems at the University of Limerick, Ireland. He has over 17 years industrial experience in the area of software development and support. His most recent role was Global Applications Development and Support Manager with responsibility for globally distributed IT teams in a US multinational. He also holds an MBA from Dublin City University, Ireland.

### **Ita Richardson**

Dr. Ita Richardson is a senior lecturer with the Department of Computer Science and Information Systems at the University of Limerick. She is Research Area Leader for Process, Practice and Methods within Lero – the Irish Software Engineering Research Centre. Ita's research focuses on software processes in particular domains, such as global software development, regulated industry, services and small to medium sized enterprises. She supervises both part-time and full-time post-graduate students. She was Research Co-Chair of EuroSPI in 2005 and 2006.