Lessons from a Failed IS Development Outsourcing Project

Completed Research Paper

Subasinghage Maduka Nuwangi **Darshana Sedera**

"Failure is simply the opportunity to begin again, this time more intelligently" – Henry Ford

Abstract

One of the main challenges of Information Systems education is lack of teaching resources that have been derived from real-world scenarios. This teaching case, which investigates a failed Information Systems Development outsourcing project, is designed to address this knowledge gap. We rarely receive an opportunity to investigate a failed project (Chua and Lam 2005), with many organizations restricting access to failed projects to minimize reputational damage (Chua and Lam 2005; Khalfan 2003). However, it is said that failure cases can provide insights that are often ignored in investigations of successful projects (Lyytinen and Robey 1999). This teaching case explains how the requirement misspecification and lack of clear understanding of the requirements could lead to project failures.

Keywords: Teaching case, project failures, Information Systems Development, Outsourcing

Introduction

Outsourcing is defined as "the use of external agents to perform an organizational activity" (King and Malhotra 2000, p. 1). According to Statista (2019), the global outsourcing market reached about 85.6 billion U.S. dollars in 2018. Some of the leading IT outsourcing service providers include IBM, Accenture, Deloitte and PwC (Gartner 2017). A survey conducted with industry professionals[1] indicated that 72% of their IT functions have been outsourced and there will be a further 31% of increase in the future (Deloitte 2016).

Information Systems Development outsourcing (ISD-outsourcing) is one of the most popular type of outsourcing, with strong and continuous growth in ISD-outsourcing initiatives (Gregory et al. 2013; Sedera et al. 2014). ISD-outsourcing is a contract-based relationship between a client and a vendor organization (Nuwangi and Sedera 2018), wherein the client contracts out all or part of its ISD activities to the vendor (Khan et al. 2011). Generally, the client has initial discussions about the project with senior executives or line of business managers of the vendor organization. Thereafter, a team of project managers, consultants, tech-leads and quality assurance managers are assigned to a project (see figure 1). During the initial stages of the project, consultants and project managers interact with a team of client representatives with the intension of identifying client requirements, project timeline and budget (Lokuge and Sedera 2014; Walther et al. 2013). Consultants / business analysts transfer the client requirements to tech leads, whereas the tech leads inform the consultants / business analysts about technical requirements and technical limitations of the information system to be developed (Sedera

[1] More than 85% of the respondents were from companies with over $1 billion annual revenue.

2011). Quality assurance team involve with business analysts and software engineers while they conduct testing, so that they can get clarifications about client requirements and/or technical limitations. Project management team interact with all team members to ensure that the project is executed according to the project plan. Many ISD projects follow agile methods (Nuwangi et al. 2012), where the information system development tasks are divided into multiple iterations with short time frames, where at the end of each iteration some proportion of the information system is delivered to the client (Boehm 1988). These iterations involve the team working through a full ISD lifecycle including requirements engineering, design, coding and testing. Generally, multiple iterations are required to release a complete software product to the clients (Sedera et al. 2004).

ISD-outsourcing is an inherently complex process due to multiple, and often conflicting client requirements, incongruence in interpreting client requirements, scope and definition creep and many user groups (Choudhury and Sabherwal 2003; Dingsøyr et al. 2012; Nuwangi et al. 2013). As such, ISD-outsourcing projects are notorious for not providing the agreed deliverables on time (Nakatsu and Iacovou 2009; Savolainen et al. 2012; Srivastava and Teo 2012). As per Standish Group (2014) average only 16.2% of ISD-outsourcing projects are completed within the expected time and budget. More alarmingly, it is estimated that 31.1% of ISD projects are cancelled before completion (Standish Group 2014) and 19% of projects completely fail (Hastie and Wojewod 2015).

The purpose of this teaching case is to explain a 'real-world' ISD-outsourcing project failure, which will be an appropriate resource for Information Systems education (e.g., Eden and Sedera 2014; Rosemann et al. 2000). There exists a gap in appropriate teaching resources that have been derived from real-world scenarios, especially on ISD-outsourcing project failures. This teaching case is designed to help address this knowledge gap. This teaching case explains about a failed ISD-outsourcing project which was commenced in 2010 and terminated in 2013. The client and the vendor were in the Asian region. The project was failed mainly because of mis-specified requirements and lack of clear understanding of the requirements. Thus, this teaching case indicates how the requirement misspecification and the lack of understanding of client requirements could lead to project failures. The case analyses were derived from seven (7) interviews with the team members of the project: senior business analyst (1), project manager (1), specialist software engineer (1), quality assurance engineer (2), associate quality assurance engineers (2) and by analyzing fourteen (14) Business Requirement Specifications (BRSs)[2].

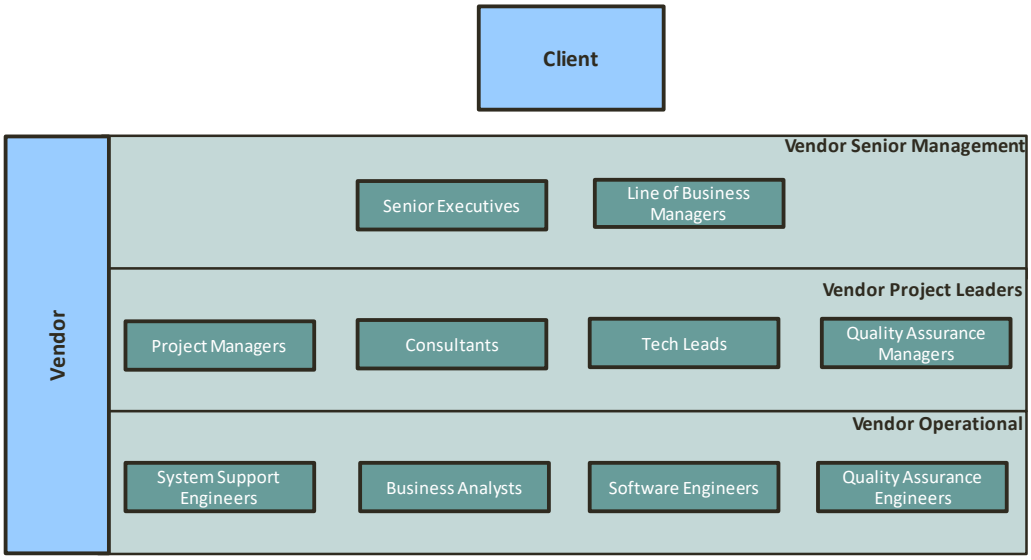

Figure 1: Team members of ISD-outsourcing projects

[2] BRSs are also referred to as software requirement specifications, functional specifications, product specifications, system specifications or requirement documents.

The Failed Project

Commissioned year: 2010

Decommissioned year: 2013

Client details: client provides securities (e.g. equity, derivatives and on-line trading) brokering services. The intension of this project was to develop a software to manage brokerage services.

Vendor details: vendor is a medium sized software development company which is specialized in capital market domain. Vendor has been in the market for more than 10 years, delivering capital market solutions to more than 25 capital market clients all over the world.

Approximate number of employees of the project:

- Senior management team (3) – line of business manager, assistant vice president software development and director business operations
- Project management team (2) – senior project managers and project managers
- Technical team (6) – tech leads, associate tech leads, senior software engineers and specialist software engineers
- Business analysts' team (3) – consultants and senior business analysts
- Quality Assurance (QA) team (5) – QA managers, QA Engineers and Associate QA Engineers
- System support engineers (1)
- User interface (UI) designers (1)

Reported key issues: 1) client requirements were not clearly identified, 2) client requirements were not properly documented, 3) inaccurate estimations of system functionalities, 4) inaccurate decisions of the consultants, and 5) Lack of involvement of the technical team during requirement engineering process.

Figure 2: Brief Information about Failed Project

The Client Organization

The client organization is a stock brokering firm operating in India. It was established in 2006 with the intension of becoming a leading financial intermediary for providing capital market access to investors. The organization had a wide range of clients including financial institutions, corporates and banks, who were engaged inequity, derivative and on-line trading. The organization provided several services to its clients: 1) mobile trading applications, 2) mobile alerts, 3) interactive charts, and 4) offline and online trading applications. The organization provided clients the real time feeds on trading of asset classes all over the world. Furthermore, it provided the ability to track the; 1) world indices – this covered the real time quotes and moments of exchanges all over the world, 2) research reports – provided an understanding of trading behaviors of stocks, markets, derivatives and mutual funds, 3) news – provided updates in the world, which have an impact on stocks and trading behaviors and 4) views – provided market expert's views and internal research team views on trading of stocks, currency and commodities. Client organization dealt with multiple exchanges, which had multiple asset classes such as equities, securities lending and borrowing[3]. Each asset class consisted of different market types such as: 1) normal markets – markets at which securities are normally traded, and 2) auction markets – when the clients were unable to deliver the due shares for the clients' sell trade, the exchange bought the shares of the relevant security in an auction market in order to deliver the shares and complete the buyer's obligation.

[3] For a wider discussion of the above concepts see for example Senarath and Copp (2015), Senarath (2016) and Senarath (2017)

The client used a legacy system to manage clearing and settlements of the trades which were facilitated through the client. However, the client was not satisfied with the performance of the legacy system. Thus, the aim of this project was to develop an efficient Information System to manage clearing and settlement of the executed trades.

The Vendor Organization

Vendor was a medium sized ISD company, engaging in stock market-related ISD. It was established in 1996 and has more than 300 employees. The company specializes in developing IS solutions for capital markets, with more than 25 capital market clients all over the world. Those solutions provide the ability to trade using multiple assets such as equities, commodities, derivatives and debt. The IS solutions include functionalities of multiple trading methods such as auctions and continuous matching[4]. Furthermore, the IS solutions provide the ability to trade in multiple market structures such as regulated exchange and the over-the-counter markets. Moreover, the company develops post-trade applications, wherein the settlement of trades is automated. Post-trade applications provide the central clearing and settlement for trades.

Vendor provides systems integration services for clients in different industry sectors such as the financial and telecommunication industries. Furthermore, the company offers consultancy services and IT infrastructure services. It is involved in developing the clients' requested functionalities (onwards and upwards) of ISD projects even after the projects go live. The company includes several partners all over the world, who provide the required outsourcing services, hardware and software services.

Specialized industry teams interact with ISD teams and marketing departments to develop ISD solutions which are aligned with client expectations. Company tries to be agile and responsive to changes in the global market. All ISD solutions are developed according to specific client requirements and to facilitate innovation and collaboration with client's business partners.

The Project

The project was initiated with the intension of developing a post-trade application, which provides clearing and settlement of trades after execution. The solution developed in this project was characterized by complex trade processing methods, which were highly integrated with clearing and settlement procedures. Some functionalities of the developed software application include;

- Trade processing – facilitated the entire life cycle of trades including trade entry, trade amendments, trade splits, trade confirmations, trade rejections, and printing of contract notes.
- User management – the system provided the ability to categorize users and assign roles for them. As per the assigned role, the user receives different privileges in the system.
- Fund processing – processed transactions through ledger accounts and provided current cash positions to clients and brokering firms.
- General accounting and journal entries – the transactions related to trade processing and general brokering activities were captured under this functionality.
- Stock processing – facilitated processing the stocks when the: 1) clients delivered shares to the brokering firm, 2) broker delivered shares to the exchange, 3) exchange delivered shares to the broker, and 4) broker delivered shares to the clients.

The Project Team

Assistant vice president and director business operations governed the project operations at a higher level to ensure project achieves expected outcomes within the stipulated time. Those two members reported to the line of business manager, who was governing several projects within the case organization. Project deliverables, work allocations and project tracking were conducted by a senior project manager and a project manager. Those two project managers were governing the system support

[4]Auction trading involves calculating the opening and closing prices of a security at the opening and closing of the trading hours whereas continuous matching operates during the regular trading sessions.

engineer, tech lead, user interface designer, consultant and QA managers. Tech lead was responsible for ensuring that the software engineering team (senior software engineers, specialist software engineers and associate teach lead) perform assigned tasks on time to the acceptable quality. Consultant and senior business analysts were responsible for client requirement analysis and documentation. When required, senior project manager and project manager govern the entire team including senior software engineers, specialist software engineers and associate teach lead, consultant and senior business analysts. Since the QA functions were outsourced to another software development company, one QA manager was hired to govern the outsourcing process. Figure 3 shows the sample project structure. These team members have been involved in multiple successful projects within the company. For example, the consultancy team was concurrently engaging in another ISD project, which was categorized as a successful project. Thus, the team members were capable of planning, analyzing and delivering successful ISD projects.

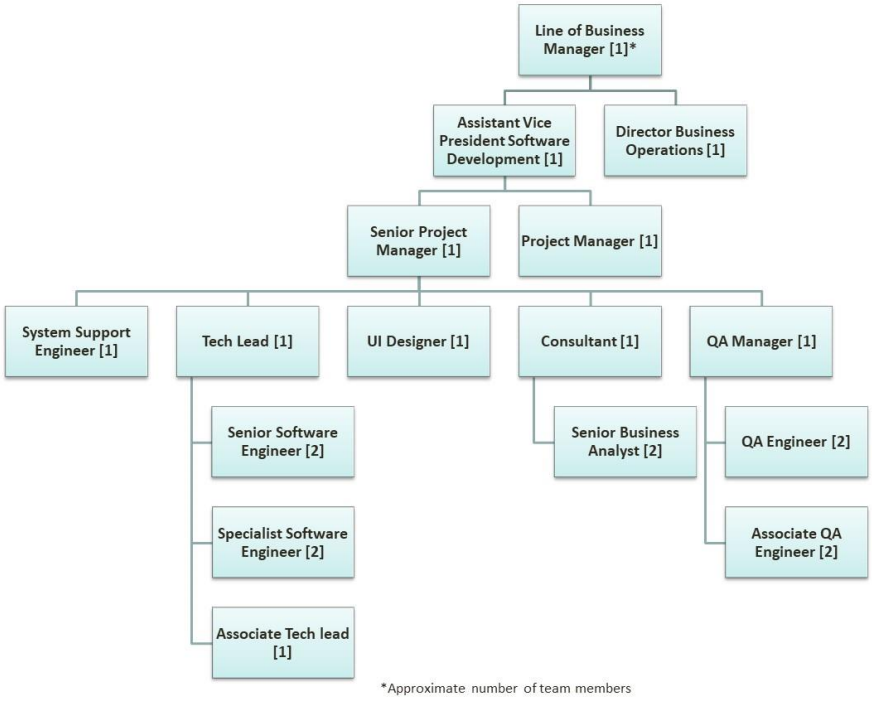

Figure 3: project structure

Early Signs of Problems

There are different stages of requirements engineering process; 1) requirements elicitation, 2) requirements analysis, modelling and communication, 3) agreeing with the requirements, and 4) evolving requirements (Nuseibeh and Easterbrook 2000). During the requirement elicitation stage, few team members of the project (i.e. a consultant, a project manager and a tech lead) visited the client premises to conduct initial discussions. During initial discussions, the team and the client were able to agree with the high-level project goals, timeline and budget. After returning, the consultant team commenced requirement analysis, modelling and documentation. During this stage, consultants created process flow diagrams to explain the process flows of main functionalities of Information System (i.e. trade processing, fund processing and stock processing) and commenced documentation of BRSs.

The business analysts decomposed client requirements in to eleven (11) requirement modules[5], which were described in 11 BRSs. BRSs consisted of information about the requirement modules including functionalities, dependencies, parameters and concepts. For example, trade processing BRS explained the procedure of entering a trade in to the system, trade processing, trade management, contract and bill

[5] Module is a group of similar requirements.

generation, trade confirmation and trade rejection procedures. Each BRS of the project contained around 50-100 pages. As specified in the deliverables dashboard (V1.0) document, requirement modules of the system were planned to be delivered in three deliverables: deliverable 1 - client registration, master data, trade processing and user management; deliverable 2 – fund processing, stock processing, brokerage taxes and charges and general accounting and journal entries; and deliverable 3 – derivatives, initial public offering and manual funds processing and depository participant module. Since trade processing, fund processing and stock processing were identified as main functionalities of the system, this study mainly focused on these three BRSs. During the project multiple iterations of requirements engineering process was conducted.

When writing BRSs, the consultant team had several conference calls with the client to get the requirement clarifications. Draft BRSs, which were documented by the consultants were sent for client review. First iteration of requirements engineering process was completed in November 2010 with following outputs: Trade processing BRS (V1.00), Fund processing BRS (V1.00) and Stock processing BRS (V1.00). The signed-off BRSs were shared with the technical team for development.

Second round of requirements engineering process was supported by the signed-off BRSs of the first round. After the second round of requirement elicitation, in January 2011, the initial BRSs of trade processing, fund processing and stock processing were updated with client comments. For example, in revision history of trade processing BRS, it was mentioned *"Jan 21, 2011 - Trade Processing (V1.01) - Updated with [client] comments (Entire document updated)"*. Second iteration of requirements engineering process was completed on January 2011 with following outputs: Trade processing BRS (V1.01), Fund processing BRS (V1.01), Stock processing BRS (V1.01), trade processing flow diagram (V1.00), fund processing flow diagram and stock processing flow diagram (V1.01). During the third iteration, a lead consultant of the project visited client site again for one month. During this period, consultant continued requirement elicitation, analysis and BRS documentation. In the revision history of trade processing BRS it was mentioned; *"March 10, 2011 – Trade Processing (V1.02) Updated spec [specification] with feedback received from the visit to [client]".*

However, one month of requirement gathering at the client site was insufficient due to the large scope of the project. A senior business analyst explained; "*Problem with the requirement gathering was in the initial part. The time given to her was a month. [..] One month is not enough. [..] Scope is very large. [..] There were business requirement specification after that month, but when the project progress we realized [..] the requirements are not very clear"*. This highlights that client requirements were not clearly identified during requirement elicitation stage. Since the discussions between client and consult team was friendly during initial agreements, the consultants had the ability to suggest and discuss functionalities of the Information System. However, draft BRSs were not reviewed by the technical team before signing off. A senior business analyst explained*; "We should have given the BRSs before signed off for the development to review. It never happened".* As a result, technical team was unable to provide information about the technical limitations of the system before signing off the BRSs.

Problems Escalating

Early signs of problems were escalated during the project execution. Although the BRSs consisted of high-level functional requirements, there were lack of information about the implementation procedures of the system. "*They signed-off the business functionality basically. BRSs don't have this is exactly how we are going to give [this] to you"* [a senior business analyst]. After the BRSs were agreed and signed-off by the clients, consultants updated BRSs including implementation details. However, the client was not informed about these updates. According to a senior business analyst; *"We did the changes on the top of signed BRSs. [..] We couldn't update the client. So, the signed-off BRSs are like one set, we have a new set of BRSs which are something different from the signed-off BRSs".* Since the BRSs did not include detail information about the requirements, QA team encountered difficulties during testing. An QA engineer explained; "*Sometimes we don't know whether it is defect or not. We don't have proper BRSs. That is the major problem".* As the signed-off BRSs did not include clear information, the client requested several new requirements after the BRSs were signed-off. A project manager discussed; *"The client [is] so demanding, whatever requirement they find out today, they put in to the go live scope.*

They say ok, this should be there, it is obvious thing it should be there, initially we didn't identify, didn't realize [the difficulty of providing the functionalities]".

During the project execution, client was required to be contacted for requirement clarifications. Since the client was not committed for project, consultant team did not receive answers for their queries. *"Their [clients'] commitment was minimum. So, when we even ask a simple question they didn't reply"* [a senior business analyst]. As a result, consultant team had to find alternative methods to elaborate client requirements. A senior business analyst mentioned; *"It was very difficult, sometimes we came up with solutions, couldn't wait for the client reply. We have to come up with the solutions and we have to elaborate on the functionalities".* Due to lack of client commitment, consultant team defined features of the system as per their knowledge and understanding of client requirements. Some of the software functionalities suggested by the consultant team were never used by the client. *"Since we don't know the exact way that they are doing that functionality we just try to come up with several alternatives which would never be used by the client. So, that was a big problem"* [a senior business analyst]. With the intension of reselling the information system to other potential clients, the consultant team included new requirements even without client request. A senior business analyst explained; *"Most of the time what we did was we added some alternatives. For example, if the client wants one and two [features] we added three and four".* One member from the technical staff joined the team for initial client visit. Other than that, there was a minimum involvement of technical team during requirements engineering process. As a result, the technical team was unable to suggest and discuss functionalities of the system.

When the project goes through multiple iterations, agreeing with the requirements became much difficult. There were many disagreements between clients and consultant team. For example, on 20th September 2011, around fifty (50) spec points[6] of trade processing BRS was updated as per the client requests during BRS finalization calls. When the consultants suggested a solution for a specific issue in the requirements or else an ISD implementation method, the technical team did not agree with the consultant's suggestions. A senior business analyst discussed: *"Most of the time, when we [consultants] suggest a problem or suggest a solution [technical team mention that] we can't do this".* This highlights that there was lack of understanding between consultant team and technical team.

Since some of the initially agreed requirements could not be implemented because of the clashes between requirements, those requirements were removed later in the ISD lifecycle. For example, as specified in the revision history of fund processing BRS, on 5th December 2011, the accounting structure of the information system had to be removed as the accounting structure could not be implemented because of the clashes between requirements. Appendix A provides a sample of fund processing BRS revision history. A senior business analyst from stated: *"This requirement cannot be implemented without that [requirement], because it is clashed with other requirement. So, a big requirement was removed".* Since the BRSs were updated after removing the functionalities, the software engineers had to amend the software code accordingly. A project manager stated: "*They [software engineers] have to change certain things, because the document [BRS] is changing, it is changing continuously. It is frequently changing. So, the developer [software engineers] can't always accommodate the changes […] It is not easy. It is not the proper practice".*

When the project goes through multiple iterations, BRSs were updated including more information. For example, trade processing BRS of the project had eight (8) main versions. Although there were only 16 pages in trade processing BRS (V1.00), trade processing BRS (V1.08) consisted of 154 pages. A senior business analyst explained; *"For like two years the BRS have been frequently been updated. So, after like two years we had 95% complete set of BRSs. Initially that was not completed"*. The requirements iterations took place for over three years and eventually the project was abandoned. A project manager mentioned; *"It is almost at the exit procedure level. So, we were [in] discussion how we get out from the project"*. A senior business analyst mentioned; *"We have temporary halted it, but we haven't stopped it. We are looking for another potential client. If we get one, we will open it again".*

[6]Spec point- a description written under a specific number in BRS (e.g. section 2.2.1 – update trade postings).

Summary of the Key Issues

Table 1 summarizes the key issues as per the four stages of requirements engineering process.

Table 1: Summary of Key Issues of the Requirement Engineering Process

Stage	Description	Key issues of requirement engineering process
Requirement elicitation	Client requirements were not clear	Client requirements were not clearly identified
	Some requirements suggested by consultants were never used by clients	Inaccurate estimations of system functionalities
	Consultant team included new requirements even without client request	Inaccurate estimations of system functionalities Lack of understanding of the consultants Inaccurate decisions of the consultants
Requirements analysis modelling and communication	Lack of information in BRSs	Client requirements were not properly documented
	Documented BRSs were updated multiple times including clarification information	Client requirements were not properly documented
	Consultants updated signed-off BRSs	Inaccurate decisions of the consultants
	Technical team disagree with the consultants' suggestions	lack of understanding between consultant team and technical team
Agreeing with the requirements	BRSs were not reviewed by the technical staff before sign-off	Lack of involvement of the technical team
	Many disagreements during BRS finalization calls	Team spirit between client and consultant team declined gradually
Evolving requirements	Client requested several new requirements after the BRSs were signed-off	Client demanding
	Some of the requirements were removed from the BRSs	Inaccurate estimations of system functionalities

Lessons Learned and Recommendations

One of the main issues in the project was lack of clear identification and documentation of client requirements. As a result, ISD team members were unable to develop an accurate software solution for the clients. Thus, it is important to have ongoing discussions with the clients, identify and document client requirements accurately. Consultant team included new requirements even without client request, which originated time constraints in the project. Thus, the consultant team should only include requirements which are requested by the client. If there are other requirements which can add value to the software solution, those should be included only after consultation with project managers, client and technical team. Consultants updated signed-off BRSs. However, the updated versions were not shared with client. As a result, client was unaware of new information included in the BRSs, which lead to issues during final stages of the project. Client requested new requirements after BRSs were signed-off, which originated time constrains in the project. Thus, the consultants and clients should understand implications of including new requirements to the project scope. Since there was lack of involvement of technical staff during requirement engineering process, they were unable to provide information about technical limitations of software solution. As a result, some requirements of software solution had to be removed during project execution. This highlights the importance of involvement of technical staff during requirement engineering stage of ISD-outsourcing projects.

Conclusion

This case study can be used in a class of Information Systems or Information Systems Project Management as a resource for understanding pitfalls and complexities of ISD process. The case analyses were derived from seven (7) interviews with the team members of the project: senior business analyst (1), project manager (1), specialist software engineer (1), QA engineer (2), associate QA engineers (2) and by analyzing fourteen (14) BRSs. This study mainly focuses on the first stage of an ISD-outsourcing project, namely requirement engineering stage. This highlights the importance of requirement engineering stage and the role of different team members in supporting requirement engineering process. This case study provides a real-world example of an ISD-outsourcing project failure; thus, the students will understand that the issues in requirement engineering stage could lead to project failures.

Teaching notes

1. Teaching objectives

- To make students aware of the importance of requirement engineering stage in ISD-outsourcing projects and the potentially serious consequences of requirement engineering issues.
- To apprise students about the role of different team members (e.g. business analysts, software engineers) in requirement engineering process.
- To apprise students about ISD-outsourcing challenges and to encourage them to factor in such challenges when planning for ISD-outsourcing projects.

2. Suggested teaching approach/plan

a. Outsourcing projects

Outsourcing is a management practice that is used by many organizations to manage business functions such as manufacturing and distribution activities (Kroes and Ghosh 2010), customer support activities (Computer Economics 2012; Kroes and Ghosh 2010) and ISD activities (Computer Economics 2012). There are two types of outsourcing: 1) onshoring or domestic outsourcing, and 2) offshoring. Prikladnicki et al. (2007) explain that onshoring occurs when "the separate entity is located in the same country where the client and the company headquarters are located". Carmel and Tjia (2005) describe offshoring as the movement of a business process done at a local company (client) to a foreign organization (vendor). Outsourcing is not a new phenomenon, but offshoring has gained more interest within the last ten years (Chua and Pan 2006).

Sample discussion questions

1. What are the benefits and risks of outsourcing projects?
2. Discuss the advantages and disadvantages of different types of outsourcing projects – i.e. onshoring and offshoring.

Sample answers

1. Benefits - Cost reduction, increased efficiency and performance, organizations can concentrate on core business functions, provide access to specialised skills and increased flexibility.
   Risks - loss of control, lack of overall cost savings, loss of in-house capabilities and lack of quality.
2. Onshoring: advantages – project management can be easier than offshored projects, less cultural barriers, disadvantages – can be expensive than offshored projects
   Offshoring : advantages – can be cheaper than onshoring projects, disadvantages – cross-cultural barriers, project management can be difficult, working in different time zones can be difficult

b. ISD-outsourcing

ISD-outsourcing remains the one of the most popular type of outsourcing, with strong and continuous growth in ISD-outsourcing initiatives (Erickson-Harris 2014; Remus and Wiener 2012; Willmott 2012). According to Khan et al. (2011), ISD-outsourcing is a contract-based relationship between client and vendor organizations wherein the client contracts out all or part of its ISD activities to the vendor. As Sakthivel (2007) highlights, most of the Fortune 500 companies outsource their ISD activities to developing countries.

Sample discussion questions

1. What are the main risks of ISD-outsourcing projects?
2. Discuss the critical success factors of ISD-outsourcing projects.

Sample answers

1. Main risks of ISD-outsourcing projects - lack of control of the ISD-outsourcing partners, lack of business and technical knowledge, requirement miscommunication and volatile requirements and lack of proper communication.
2. Critical success factors - a minimal knowledge gap between the client and vendor, minimized costs, the availability of skilled human resources, application of effective control mechanisms and accurate identification and documentation of client requirements.

c. Information Systems Development process

ISD projects commence with a contractual agreement between the client and the ISD company. ISD projects consist of several stages such as requirement engineering, design, development and testing (Boehm 1988; Kneuper 2018).

- Requirement engineering stage – In this stage, the business analysts identify and document the client requirements by conducting several discussions with the client. There are sub-stages of requirements engineering stage; 1) requirements elicitation, 2) requirements analysis, modelling and communication, 3) agreeing with the requirements, and 4) evolving requirements (Nuseibeh and Easterbrook 2000). BRSs, which describes client requirements are produced during requirement engineering stage.
- Design stage – This stage consists of conceptualising and framing the final IS solution according to the requirements identified in the requirement analysis stage. The software design includes architectural design as well as the component and algorithm design. Several documents such as design specifications, interface design specifications and test plans are produced in this stage.
- Development stage – The software engineering team conducts the ISD during this stage. This stage includes writing, maintaining and integrating the source code of the final IS solution. The software engineers are required to develop the relevant requirement modules assigned to them.
- Testing stage – The primary purpose of this stage is to estimate the quality of the IS solution. The software QA team follows a variety of testing approaches such as integration testing, load testing and system testing to ensure that the software solution: 1) executes the functions accurately, 2) executes the functions within the expected time, and 3) meets the client's requirements.

Sample discussion questions

1. What are the challenges of ISD process?
2. What are the salient challenges of requirement engineering stage?

Sample answers

1. Lack of understanding of client requirements, lack of knowledge transfer mechanisms, technical limitations and difficulties in project management
2. Incomplete or inaccurate requirements, requirement volatility and lack of client commitment

c. Information Systems Development process models

To decide the order of stages and transition criteria for each stage, ISD projects utilise process models (Boehm 1988). Process models explain "what shall we do next" and "how long shall we continue to do it" (Boehm 1988, p. 61). ISD process models can be subdivided in to two: plan-driven and agile. While plan-drive process models are most suitable for the projects with stable environment with clear requirements, agile process models are suitable for projects in volatile environments (Kneuper 2018). Examples of plan-driven models include waterfall model, V-model and Rational Unified Process (RUP). SCRUM, Boehm's Spiral model, Extreme Programming (XP) are examples for agile process models (Kneuper 2018).

Sample discussion questions

1. Discuss the differences between plan-driven models and agile process models.
2. What are the critical success factors of plan-driven models and agile process models?

Sample answers

1. Differences

This table was prepared by collating information from Boehm and Turner (2003)	
Plan-driven	**Agile**
Relay on specifications and project plans developed at the beginning of the project.	Require dedicated customer representatives throughout the project
Team members have to follow clear policies and procedures	Team members have more degree of freedom
Relay on explicit documented knowledge	Relay on tacit and interpersonal knowledge. Thus, more frequent person-to-person communication is necessary.

2. Critical success factors

Plan-driven	**Agile**
Complete and accurate specification of requirements	Appoint dedicated customer representatives for the project
Team members should follow clear policies and procedures	Establish more frequent communication between team members
Define project scope and timelines	Receive ongoing communications and feedback from the client

d. Team members of ISD projects

ISD projects consist of a team that is focused on achieving the common goal of completing the IS solution: 1) according to the client requirements, 2) within the stipulated time, and 3) within the stipulated budget. The team members of ISD projects include:

- Business analysts' team – the main responsibility of the business analysts' team is to write the BRSs which describe the clients' business requirements. Thus, the business analysts' team work as a conduit between the clients and the other team members in the ISD project. The business analysts' team consists of business analysts, senior business analysts, consultants and senior consultants.

- Technical team – The responsibilities of the technical team include writing the design specifications and developing the software according to the BRSs and design specifications. The technical team consists of software engineers, senior software engineers, specialist software engineers, principal software engineers, technical leads and senior technical leads. Software engineers are sometimes referred to as developers.

- QA team – The responsibilities of the QA team include writing the test scenarios and test case specifications, and conducting the software testing according to the test scenarios and test case specifications. The QA team consists of associate QA engineers, QA engineers and senior QA engineers.

- Project management team – The project management team is required to prepare the project plans and ensure the project is executed according to the project plans. The project management team consists of project managers, junior project managers, associate project managers and senior project managers.

- Software support engineers – The responsibilities of the software support engineers include administration of SQL databases, system monitoring and supporting the technical team in the ISD process.

Sample discussion questions

1. How could an ISD team and minimize challenges of ISD-outsourcing projects?
    a. What are the responsibilities of Business Analysts' team in minimizing challenges?
    b. What are the responsibilities of technical team in minimizing challenges?
    c. What are the responsibilities of client in minimizing challenges?

Sample answers

1. Responsibilities of the ISD team
    a. Business Analysts – ensure client requirements are identified and documented accurately
    b. Technical team – ensure software solution is developed according to client requirements and inform business analysts about the technical limitations of the project
    c. Client – provide client commitment for the project and clarify any issues regarding client requirements

References

Boehm, B., and Turner, R. 2003. "People Factors in Software Management: Lessons from Comparing Agile and Plan-Driven Methods," *Crosstalk-The Journal of Defense Software Engineering*), pp. 1-13.

Boehm, B. W. 1988. "A Spiral Model of Software Development and Enhancement," *Computer Modelling and Simulation of Smart and Green Computing Systems* (21:5), pp. 61-72.

Carmel, E., and Tjia, P. 2005. *Offshoring Information Technology: Sourcing and Outsourcing to a Global Workforce*. Cambridge University Press.

Choudhury, V., and Sabherwal, R. 2003. "Portfolios of Control in Outsourced Software Development Projects," *Information Systems Research* (14:3), pp. 291-314.

Chua, A., and Lam, W. 2005. "Why KM Projects Fail: A Multi-Case Analysis," *Journal of knowledge management* (9:3), pp. 6-17.

Chua, A. L., and Pan, S. 2006. "Knowledge Transfer in Offshore Insourcing," in: *International Conference on Information Systems (ICIS)* United States: AIS Electronic Library (AISeL), pp. 1039 - 1054.

Computer Economics. 2012. "IT Outsourcing Statistics 2012/2013."

Deloitte. 2016. "Deloitte's 2016 Global Outsourcing Survey."

Dingsøyr, T., Nerur, S., Balijepally, V., and Moe, N. B. 2012. "A Decade of Agile Methodologies: Towards Explaining Agile Software Development," *Journal of Systems and Software* (85:6), pp. 1213-1221.

Eden, R., and Sedera, D. 2014. "The Largest Admitted IT Project Failure in the Southern Hemisphere: A Teaching Case," *35th International Conference on Information Systems: Building a Better World Through Information Systems*, Italy: AISeL.

Erickson-Harris, L. 2014. "IT Outsourcing Spend: Slow and Steady for 2014." from http://www.nearshoreamericas.com/outsourcing-spend-slow-steady-2014/

Gartner. 2017. "Market Share Analysis: IT Outsourcing Services, Worldwide, 2016."

Gregory, R. W., Beck, R., and Keil, M. 2013. "Control Balancing in Information Systems Development Offshoring Projects," *MIS Quarterly* (37:4), pp. 1211-1232.

Hastie, S., and Wojewod, S. 2015. "Standish Group 2015 Chaos Report." InfoQ.

Khalfan, A. 2003. "A Case Analysis of Business Process Outsourcing Project Failure Profile and Implementation Problems in a Large Organisation of a Developing Nation," *Business Process Management Journal* (9:6), pp. 745-759.

Khan, S. U., Niazi, M., and Ahmad, R. 2011. "Barriers in the Selection of Offshore Software Development Outsourcing Vendors: An Exploratory Study Using a Systematic Literature Review," *Information and Software Technology* (53:7), pp. 693-706.

King, W. R., and Malhotra, Y. 2000. "Developing a Framework for Analyzing IS Sourcing," *Information & Management* (37:6), pp. 323-334.

Kneuper, R. 2018. "Software Processes and Life Cycle Models: An Introduction to Modelling, Using and Managing Agile, Plan-Driven and Hybrid Processes." Switzerland: Springer, pp. 1-344.

Kroes, J. R., and Ghosh, S. 2010. "Outsourcing Congruence with Competitive Priorities: Impact on Supply Chain and Firm Performance," *Journal of Operations Management* (28:2), pp. 124-143.

Lokuge, S., and Sedera, D. 2014. "Enterprise Systems Lifecycle-Wide Innovation," *Americas Conference on Information Systems (AMCIS 2014)*, Savannah, Georgia: AIS.

Lyytinen, K., and Robey, D. 1999. "Learning Failure in Information Systems Development," *Information Systems Journal* (9:2), pp. 85-101.

Nakatsu, R. T., and Iacovou, C. L. 2009. "A Comparative Study of Important Risk Factors Involved in Offshore and Domestic Outsourcing of Software Development Projects: A Two-Panel Delphi Study," *Information & Management* (46:1), pp. 57-68.

Nuseibeh, B., and Easterbrook, S. 2000. "Requirements Engineering: A Roadmap," in: *Conference on the Future of Software Engineering*. Limerick, Ireland: ACM Digital Library, pp. 35-46.

Nuwangi, S., Sedera, D., and Srivastava, S. C. 2013. "Information Systems Development Outsourcing: The Role of Control Configurations," in: *Thirty Fourth International Conference on Information Systems*. Milan, Italy.

Nuwangi, S. M., and Sedera, D. 2018. "Too Tight - Too Loose: Controlling Lessons from a Failed IS Development Project," in: *Australasian Conference on Information Systems*. Sydney, Australia: pp. 1-10.

Nuwangi, S. M., Sedera, D., and Murphy, G. 2012. "Multi-Level Knowledge Transfer in Software Development Outsourcing Projects: The Agency Theory View," in: *33rd International Conference on Information Systems*. Orlando, FL.

Prikladnicki, R., Audy, J. N. L., Damian, D., and De Oliveira, T. C. 2007. "Distributed Software Development: Practices and Challenges in Different Business Strategies of Offshoring and Onshoring," *Second IEEE International Conference on Global Software Engineering*: IEEE, pp. 262-274.

Remus, U., and Wiener, M. 2012. "The Amount of Control in Offshore Software Development Projects," *Journal of Global Information Management* (20:4), pp. 1-26.

Rosemann, M., Sedera, W., and Sedera, D. 2000. "Industry-Oriented Education in Enterprise Systems," *Australasian Conference on Information Systems*, Brisbane, Australia: AIS.

Sakthivel, S. 2007. "Managing Risk in Offshore Systems Development," *Communications of the ACM* (50:4), pp. 69-75.

Savolainen, P., Ahonen, J. J., and Richardson, I. 2012. "Software Development Project Success and Failure from the Supplier's Perspective: A Systematic Literature Review," *International Journal of Project Management* (30:4), pp. 458-469.

Sedera, D. 2011. "Size Matters! Enterprise System Success in Medium and Large Organizations," in *Enterprise Information Systems: Concepts, Methodologies, Tools and Applications*. IGI Global, pp. 958-971.

Sedera, D., Gable, G. G., and Chan, T. 2004. "Knowledge Management as an Antecedent of Enterprise System Success," *Proceedings of the 10th Americas Conference on Information Systems*, N.C. Romano (ed.), New York City, New York: Association for Information Systems, pp. 121-127.

Sedera, D., Lokuge, S., Krcmar, H., Srivastava, S. C., and Ravishankar, M. N. 2014. "The Future of Outsourcing in the Asia-Pacific Region: Implications for Research and Practice—Panel Report from PACIS 2014," *Communications of the Association for Information Systems* (35:1), pp. 317-331.

Senarath, S. 2016. "Not So 'Bankruptcy-Remote': An Insight into Sri Lankan Securitization Practices in a Post_Gfc Context," in: *Multidisciplinary Academic Conference on Management, Marketing and Economics*. pp. 53-60.

Senarath, S. 2017. "The Dodd-Frank Act Doesn't Solve the Principal-Agent Problem in Asset Securitisation." LSE Research Online: LSE Business Review.

Senarath, S., and Copp, R. 2015. "Credit Default Swaps and the Global Financial Crisis: Reframing Credit Default Swaps as Quasi-Insurance," *Global Economy and Finance Journal* (8:1), pp. 135-149.
Srivastava, S. C., and Teo, T. S. H. 2012. "Contract Performance in Offshore Systems Development: Role of Control Mechanisms," *Journal of Management Information Systems* (29:1), pp. 115-158.
Standish Group. 2014. "The Standish Group Report: Chaos."
Statista. 2019. "Global Market Size of Outsourced Services from 2000 to 2018 (in Billion U.S. Dollars)."
Walther, S., Sedera, D., Sarker, S., and Eymann, T. 2013. "Evaluating Operational Cloud Enterprise System Success: An Organizational Perspective," *European Conference on Information Systems (ECIS 2013)*, Utrecht, p. 16.
Willmott, D. 2012. "Report: Cios to Accelerate Outsourcing in 2013." Dice: The Carrier Hub for Tech.

Appendix A: Revision history of fund processing BRS

Date	Version	Description
December 5th, 2011	1.03_4	**Account Creation** [Amended] 'Account Structure' as 'Account Creation' [Removed] Separate account structures are maintained for Cash and Delivery accounts. [Added] XXXXXXXXXXX [7] [Removed] Account category since the system will maintain two categories for cash and delivery separately. [Added] XXXXXXXXXXX [Added] XXXXXXXXXXX [Removed] XXXXXXXXXXX [Added] Reference number [Removed] Reference number in a ledger account. [Added] XXXXXXXXXXX [Added] XXXXXXXXXXX [Amended] XXXXXXXXXXX [Added] XXXXXXXXXXX [Removed] Each *entity* created in the system will have an accounting structure attached to it. [Removed] XXXXXXXXXXX [Removed] The accounting structure will dictate the accounts created by the system for each instance [Added] XXXXXXXXXXX [Removed] XXXXXXXXXXX [Removed] The levels in the accounting structure since accounting structures will not be maintained in the system. [Removed] Example for maintaining accounts at multiple levels [Removed] A default accounting structure will be configured for each entity in the system. [Removed] XXXXXXXXXXX

[7] It was required to blackout the sensitive information to maintain the confidentiality.