

Cultural Influence on Requirements Engineering Activities: Australian Practitioners' View

Tawfeeq Alsanoosy

RMIT University,

Melbourne, Australia

tawfeeq.alsanoosy@rmit.edu.au

Maria Spichkova

RMIT University,

Melbourne, Australia

maria.spichkova@rmit.edu.ua

James Harland

RMIT University,

Melbourne, Australia

james.harland@rmit.edu.au

Abstract

Requirements Engineering (RE) involves the critical activities required to capture users' requirements accurately, completely and in line with users' needs. However, since RE is a communication-intensive activity, an individual's culture might profoundly influence the effectiveness of RE practices. We conducted interviews with 16 Australian practitioners, supplemented by follow-up interviews to consolidate the data. Our study aims to empirically identify the cultural aspects that influence RE activities, analyse the implications of these, and present solutions to address these cultural aspects.

Keywords: Requirement Engineering, Software Engineering, Cultural Aspects

1. Introduction

Cultural empirical studies show that individuals' values in the workplace are influenced by their cultural background [11, 13]. Consequently, culture can play a critical role in determining how individuals and corporations operate and how they employ techniques or practices to achieve their goals. One of the most commonly accepted definitions of “*culture*” was introduced by Hofstede, who defines culture as “*collective programming of the mind which distinguishes members of one human group from another*” [11]. Moreover, Requirements Engineering (RE), i.e., requirements elicitation, analysis, specification, validation, and management, is one of the primary activities for developing software. It requires intensive communication between the software stakeholders (customers, project owner, requirements engineers, etc.), in order to elicit, document, and achieve their requirements satisfactorily. There are social and cultural concerns that can affect the success of the RE process, and these cannot be ignored [2, 8, 13].

Stakeholders' involvement in the RE process has direct positive effects on achieving successful outcomes. However, there are many factors (e.g. managerial, political, or cultural) that might affect the success of such involvement, particularly end users [4]. Because software development is highly sensitive to cultural characteristics [3], individuals' cultures might significantly influence RE activities. The success of the RE process depends on understanding individuals' cultures and behaviours [2, 13, 3]. However, there is a lack of research exploring the influence of culture on RE activities [14]. We believe that it is crucial to identify the cultural characteristics that could influence RE practices, and to determine precisely how RE activities are affected, and how the negative influences of some cultural idiosyncrasies can be mitigated.

Related work: Many challenges facing RE practice can be traced back to inadequate communication between software stakeholders and to cultural differences. However, only a small number of studies have been conducted to investigate the impact of culture on the

RE process, where communication is critical. Ramesh et al. [12] investigated the interplay between the basic tenets of agile methods (e.g. flexibility, open communication, etc.) and the Eastern cultures of China, India, and Korea. The study revealed that cultural features such as empathy and the need for saving face and significantly influence the adoption of agile RE. Damian and Zowghi [8] reported on the RE challenges introduced by distributed stakeholders in a multi-site organisation, across four different sites in the USA, Australia, New Zealand, and Europe. They concluded that inadequate formal communication, cultural differences and lack of trust had negative impacts on the RE process. The authors provided some suggestions to improve RE practices for the studied organisation. Thanasankit [13] conducted a study on the impact of the Thai culture on the RE process, focusing on the effect of unequal distribution of the cultural power on decision-making. The results of the study highlighted that the success of the RE process requires understanding the social and cultural characteristics of the software stakeholders. Ayed et al. [3] explored the impact of Asian culture on agile methods based on Hofstede's cultural model [11]. The study concluded that the nature of the society and culture has a strong influence on agile practices. In this paper, we investigated the influence of Australian culture on RE practices.

In our previous work, we proposed a general idea of a framework, based on Hofstede's model [11], to investigate the influence of culture on the RE process [1]. The framework was applied to a pilot case study in a conservative culture (Saudi Arabia). The results confirmed the feasibility of the framework. Also, two case studies were conducted with eight Australian and eight Saudi Arabian practitioners [2]. The results indicated that: 1) effective RE practices require an understanding of the stakeholders' cultural backgrounds; and 2) more interviews and more comprehensive analysis are required to investigate the influence of culture on RE activities.

Contributions: In this paper, we provide a deeper analysis of the influence of national culture on RE activities, focusing on Australian culture. To explore the concept of culture, we adopted our proposed idea of the theoretical framework [1] as well as data collected from RE practitioners, as a basis for the analysis. The results of our current work provide the foundation for developing a framework to describe the influence of culture on RE activities. We conducted 16 face-to-face interviewees with RE practitioners working in 16 different Australian companies located in Melbourne; this was supplemented by follow-up interviews to confirm the original findings. The collected data was analysed using a thematic analysis approach. We identified 13 cultural characteristics that influence RE activists, analysed their effect on RE practices, and proposed several solutions to overcome any negative influences. It is anticipated that the findings presented in this paper will prove valuable to RE practitioners who are working with Australian stakeholders, and/or working in countries with scores similar to those for the cultural dimensions profiles of Australia (as per Hofstede's cultural model [11]). The goal is to raise RE practitioners' awareness of the culture-specific aspects influencing RE activities, enabling them to establish appropriate strategies to address any potential culture-related difficulties, thereby improving collaboration and RE outcomes.

2. Study Design

The research question that motivated this study was "How do stakeholders' cultural characteristics influence requirements engineering activities?" The goal was to understand how the RE process is affected by individuals' cultures. We adopted a mixed-method case study design using an exploratory strategy [7, 9, 16]. The mixed-method approach was chosen because it offers a comprehensive understanding of the research problem by using the strengths of both quantitative and qualitative research [7]. Likewise, the case study assisted us to explore in depth the interplay between human behaviour and organisational practice within real-life contexts, as suggested by Yin [16]. The design comprised two phases. In the first phase, we collected and analysed qualitative data to address the research question. Then, the second quantitative phase was designed to test and generalise the initial findings derived from the qualitative phase.

2.1. Phase 1: Interviews

We conducted 16 interviews with practitioners from 16 different organisations in Australia. Creswell and Clark [7] suggested that a range of 4 to 12 participants is sufficient when collecting data from a homogeneous sample, whereas Guest et al. [10] suggested that 12 in-depth interviews are adequate to reach saturation. Thus, we conducted 16 interviews to ensure that we reached saturation. The interview was semi-structured with open-ended questions related to the cultural features that influence the RE process in the Australian context. The interview questions are available online¹. The interview questions and consent form were sent to the participants three days before each interview. In each case, we started by explaining the research objective to participants and then conducted the interview. The interview questions were intended to identify the influence of culture on RE activities that involve communication between the RE practitioners and users/clients. However, we did not restrict the participants to express their opinions about other perceived issues, in addition to the focus on “RE practitioners vs. users/clients”. All interviews were conducted face-to-face and the sessions lasted for an average of 1.5 hours. All the interviews were held in the city of Melbourne (Victoria) at the interviewees’ offices.

We used two sampling strategies to recruit the interviewees: purposive and snowballing. Applying purposive strategy, we first used our personal network to recruit participants and then we applied strict criteria to their profiles (e.g., LinkedIn and personal websites) to decide whether they had the necessary experience and expertise to participate. Each potential participant was then sent a personal invitation via email. The targeted population included practitioners who had: (1) engaged in eliciting the requirements from clients, (2) been involved in the RE process during systems development, and (3) worked in medium-sized to large-sized Australian software companies. To increase the number of participants, we employed the snowballing strategy by asking each interviewee to propose other potential interviewees. We carefully selected 16 practitioners: 11 of them are Australian-born and five interviewees were originally from different countries such as Egypt, Pakistan, and Italy, but had integrated the Australian culture and have worked in Australia, particularly in Melbourne, for several years. Most of the Australia-born participants had worked in cities other than Melbourne. The work experience and roles of practitioners are presented in Table 1. In Table 1, size refers to the company size: L means that the company is large, whereas M means that the company is medium.

A thematic analysis method was adopted to analyse the qualitative data. Thematic analysis is beneficial in describing the important themes that emerge from the data [6]. We used the NVivo data analysis tool, which enabled a systematic and comprehensive analysis and comparison of emerging themes. The thematic analysis method, recommended by Braun and Clarke [6], includes six phases: 1) reading the transcripts line-by-line to check the data and extract key points; 2) creating initial codes by labelling essential aspects; 3) grouping identified codes into potential themes; 4) re-evaluating the extracted themes against each other to merge presumably related themes or exclude the themes with low evidence support; 5) defining each theme by describing its nature and scope; and 6) reporting the themes that emerged.

2.2. Phase 2: Follow up

Based on the themes that emerged from the analysed interview data, we conducted follow-up interviews with the same interviewees who participated in the first phase. The follow-up phase started immediately after all analysis of phase 1 data was completed (approx. three months after the initial interviews). 13 out of 16 interviewees participated in the follow-up interviews (see Table 1). These second interviews were conducted with the same interviewees in order to: 1) consolidate the previously-collected data, 2) elicit interviewees’ opinions about any cultural characteristics that they did not mention during the first interview, and 3) collect quantitative data to measure the predominance of the identified cultural features. The interviewer began by introducing the objectives of the interview.

¹ <https://sites.google.com/view/australian-cultural-influences/home>

Interviewees were invited to respond to 27 close-ended questions, aimed at collecting quantitative data. The questions were formulated based on the analysis of data obtained from phase 1. For example, if the theme “hidden agenda” was identified, our question asked whether a hidden agenda influences the RE process.

The questions were divided into three sections: 1) whether the identified cultural characteristic influences the RE process. The interviewees were given three options (Yes, No, Not sure) and *had to provide an answer*; 2) the RE activities that are affected by this particular characteristic; and 3) whether the characteristic has a positive or negative impact on RE. Almost all interviews were conducted face-to-face and, on average, lasted for 30 minutes. The data were analysed using descriptive statistics, particularly frequency analysis [5]. We calculated the total response given to each theme and annotated these with [✓N] or [XN], where N indicates the number of all responses reflecting an aspect, and ✓ and X donate positive and negative impacts respectively. For instance, [✓5] means that five participants agreed on this theme and it has a positive impact.

Table 1. List of participants years of experience, role and follow-up practitioners

Interviewee	Years	Role	Size	RE process	Working for	Follow-up
A1	30	Requirements Engineering Consultant	L	Agile, waterfall	Government/Private	Agreed
A2	17	Requirements Engineer	M	Agile, waterfall	Government/Private	No reply
A3	17	Requirements Engineer	M	Lean, waterfall	Private	Agreed
A4	7	Requirements Engineering Researcher	—	—	—	Agreed
A5	30	Change Management Leader	L	Waterfall	Government/Private	No reply
A6	40	Project Manager	L	Agile, waterfall	Government/Private	Agreed
A7	10	Requirements Engineering Consultant	M	Agile	Government/Private	Agreed
A8	15	Requirements Engineer/ Architect	M	Lean	Government/Private	Agreed
A9	22	System Engineer	L	Agile, waterfall	Government/private	Agreed
A10	50	Principal System Engineer	L	Waterfall	Government/Private	Agreed
A11	7	Software Engineer	L	Agile	Private	Agreed
A12	40	System Analyst/Project Manager	M	Agile	Government/Private	Agreed
A13	30	System Analyst	M	Waterfall	Government/Private	No reply
A14	22	Requirements Engineer	L	Agile	Private	Agreed
A15	27	Requirements Engineer/Developer	M	Agile, waterfall	Government/Private	Agreed
A16	5	Requirements Engineer	L	Waterfall	Government	Agreed

3. Case Study: Results and Analysis

This section presents a detailed analysis of the cultural aspects that emerged from the interviews. The findings aim to: 1) determine the extent to which cultural characteristics influence RE activities; and 2) investigate the implications of these aspects on RE practices and its outcomes.

3.1. Hidden agenda

In RE, a high level of transparency among software stakeholders is required to effectively elicit and implement users' requirements. Hofstede et al. [11] argue that Australian people stress the needs of the individual over the needs of the group. In total, five interviewees expressed that software stakeholders might hide some important information for various reasons (A1, A4, A5, A10, A13). For example, executive managers on the customer side might deliberately change, push, or approve requirements just to achieve their own agenda without justifying their decision, especially if it is politically-motivated. One practitioner (A5) emphasized that managers might “*express requirements as being really important because they want something else done that they are not going to tell you*”. Also, practitioners might hide some information from clients. A4 and A10 declared that practitioners might tell clients “*this is how we develop things*” or we might find that a “*software architect drives the architecture to achieve*” a specific agenda.

In the follow-up phase, the interviewees agreed that hidden agendas negatively affected requirements elicitation, analysis and change management. This claim was supported by seven interviewees (so we denote this as [X7]). However, two interviewees expressed that hidden agendas might also positively affect RE outcomes, if managers had a good idea of what the

outcomes need to be [✓2].

As per Wieggers and Beatty [15], a good RE practice is to establish and prioritise realistic requirements based on users' needs. Hidden agendas impede this practice because requirements are prioritised based on an individual's or a company's agenda, instead of being based on users' needs. A4 commented, "*sometimes, people have very defined personal agendas and they are not very explicit to end users' needs*". It might also affect the overall effectiveness of the software and increase the chance of software failure. Thus, it is crucial for practitioners to keep in mind that clients might have a hidden agenda and probe deeply to identify users' needs.

3.2. Resistance to accepting changes

Dealing with users' resistance to change is critical to the success of the RE process. Eight interviewees provided three different reasons for clients resisting changes to the status quo; resistance due to the clients' role, new requirements stemming from changes, or apprehension about changes to the user process (A1, A4, A6, A7, A8, A9, A12, A14). Project managers resisted new changes if they meant an increase in costs and exceeding the allocated budget, especially if they were not contractual (A1, A5, A7). For example, the business team would argue for the need for the new requirements and a manager would argue against the changes because of the contractual cost. Experts often ignored the proposed changes because they believed that they know better and the proposed changes to the current process would not improve their work (A1, A6, A8). A8 commented that if "*we can optimise some things, and they [experts] feel you are challenging their judgement, they will be more resistant*". Novel users resisted accepting new software/requirements because either they misunderstood the value of the proposed change or were fearful of losing their jobs or their position (A6, A7, A8). In contrast, four requirements engineers mentioned that they accepted new changes as a part of their work and they usually asked for justification of the reasons for changes (A1, A5, A7, A11).

An analysis of the follow-up interview data showed that user resistance was one of the major cultural aspects affecting RE in Australia. The practitioners agreed that it had a direct negative effect on requirement elicitation, validation and change management [X11].

One of the best RE practices is to accurately assign cost and resources to the RE process [15]. User resistance contradicts this practice because practitioners would not easily be able to complete or close the RE phase/sprint. This causes a huge delay in delivering the software project on time and within the budget. Also, it might be hard for requirement engineers to communicate easily with the end user or receive constructive feedback. Thus, practitioners might need to establish appropriate strategies to counter users' resistance. For instance, they may seek top management support because this would strongly reduce behavioural resistance or explain the purpose and benefits of the new solution to the users.

3.3. Managers' influence

Management practices influence requirements determination and approval [8]. Hofstede et al. [11] argue that, in some cultures, *managers rely on their own experience and on subordinates* to make decisions. Five interviewees reported that decisions about requirements were influenced and manipulated by an exclusive/department manager (A1, A4, A6, A9, A10). Interviewees called this type of power "*influential power*", which refers to the personal characteristics of managers (e.g., negotiation power and communication skills) that influence people or situations. The problem was that every department wanted the system to be implemented in the way they wanted, rather than in the way that worked for everyone. For instance, managers might change the decision to support their departments' requirements through managers' communications and power. Thus, the proposed solution might not work effectively for all departments.

The follow-up interviewees also agreed that managers' influence negatively affected the requirement elicitation, specification, validation, and change management [X7]. For example, the decision might be manipulated after being agreed upon during the requirement elicitation session, which also affected requirements specifications.

The important aspect of the RE process is the recognition of the fundamental nature of its practices as a decision-making process. In RE, decisions involve difficulties such as uncertainty, conflicts, and managerial influence, which might contradict the decision-making process. Therefore, it might be necessary for requirements engineers to inform managers about any possible negative consequence of their decisions and discuss what would be beneficial to achieve the organisation's goals and users' needs.

3.4. Solution-focused requirements

Requirements describe the capability of software and define its functions that are utilised to meet users' needs. Six practitioners reported that requirements were overly solutions-focused constructions rather than concerned with meeting users' needs, mainly in government projects (A8, A9, A10, A13, A15, A16). The practitioners emphasised that domain experts focused or refocused the requirements into the solutions space rather than focusing on a purely functional space, based on the customers' requests. This means that the construction of the software requirements specification (SRS) was solutions-based rather than user-needs-based. The follow-up interviewees agreed that solution-focused requirements negatively affected RE because it constrained the design to the solution and clients to describe the logical behaviour of the system [X8]. Thus, clients might ask for frequent changes because the solution did not meet their needs.

In RE, writing SRS is pivotal to the success of any software project. Requirements are not an aspect of design nor a proposal to show how to implement a solution [15]. This aspect contradicts the purpose of SRS. When the solution is formulated according to the requirements definition, it constraints the possible outcomes and provides only general ideas about users' needs. Defining the solution would also constrain the possible outcomes or make requirements redundant, which might be a source of error since it may be interpreted differently by various developers. Also, it would be difficult for practitioners to measure, validate or develop a solution since the solution already exists. Therefore, practitioners need to identify what users want beyond only the requirements/solution and direct users to focus on identifying their needs.

3.5. Australian English Language

Australian English differs from British and American English, which might introduce barriers to communication with non-Australian stakeholders. Because of Australian English, four practitioners commented that we might use certain phrases or idioms that do not make any sense to non-Australian stakeholders (A1, A2, A4, A14). Practitioners found that non-Australian stakeholders translated these phrases literally into their own mother tongue. Because these phrases do not have any meaning in their culture and language, they cause serious conflicts during the elicitation stage. A2 commented that "*the client thought that I was attacking him*".

In the follow-up interviews, participants agreed that using Australian dialogue or phrases negatively affected requirements elicitation [X5]. Thus, it might be important for practitioners to be trained to avoid using complex sentences and idiomatic phrases, and to provide suggestions in writing to allow time for digesting the language.

3.6. Solving conflicts by compromising

According to Hofstede et al. [11] some cultures prefer to resolve conflicts by negotiation, while others resolve conflicts through force. In regard to conflicts, seven participants agreed that most of the conflicts were resolved by negotiation and compromise at the appropriate level, based on the role and responsibilities of an individual. For example, if conflicts were resolved at the end user's level, practitioners would not escalate the issue to a higher level. A15 stated that "*there is a government structure for each project working level, management level, and then the Steering Committee level. If it [conflict] cannot be resolved at a lower level, it goes up*". The follow-up participants agreed that solving

conflicts by negotiation had a positive effect on RE [✓6].

One of the responsibilities of requirements engineers is to resolve conflicts to ensure that decisions are aligned with business objectives [15]. Prior studies revealed that social structure and unequal distribution of power negatively impede the resolution of conflicts [13]. However, we found that conducting negotiations with the responsible users would enable software stakeholders to 1) quickly come to an agreement over the issues, and 2) meet the interests of end users. Thus, it complements RE practices, and practitioners need to be aware that it is preferable to discuss and resolve conflicts directly with users.

3.7. Establish trust

Effective communication involves a high level of trust because trust can influence information exchange and disclosure [8]. Eight interviewees noted that trust was an important element in the effective delivery and implementation of software solutions (A1, A4, A6, A10, A11, A12, A15, A16). However, only two interviewees had encountered a serious trust issue with Australian customers (A1, A12). A15 believed that *“business in Australia is generally based on trust”*. The analysis of the follow-up interviews indicated that there was a high level of trust among software stakeholders [✓7]. The participants agreed that trust positively affected the RE process.

RE practices such as holding elicitation workshops, providing feedback, sprint retrospectives, or requirements reviews require trust because this is important to Australian stakeholders. Thus, trust enhances RE practices and needs to be established at the start of the RE process. In Australia, trust can be established by delivering high quality software, building a relationship, or by practitioners acknowledging their limitations and capabilities in meeting users' requirements.

3.8. Openness and honesty

RE involves intensive communication among software stockholders and it may be difficult to achieve [8, 15]. Hofstede et al. [11] state that some cultures encourage the honest sharing of feelings in the workplace. Nine interviewees expressed that openness and honesty influenced the RE process (A1, A4, A5, A6, A7, A8, A12, A14, A15). A1 emphasised that *“Australia is quite a good place to gather requirements because they are often open and very honest”*. The follow-up participants agreed that it positively affected requirements elicitation, validation and management [✓12]. It assisted and complemented the RE process in the ways explained below.

1. Building trust: Participants found that trust can be built through clearly describing the benefits and challenges of the current software and admitting the limitations of the software team (e.g., time, resources, and misunderstanding of the requirements). A12 said *“I am honest. If I do not know, I tell clients I do not know. I think that builds a lot of trust”*.

2. Reducing conflicts: An open discussion of requirements enables requirements engineers to solve conflicts because everyone was encouraged to his/her views during the elicitation/ validation workshop. A6 believed that *“open discussions give you a platform to migrate those changes with less conflict”*. Also, a practitioner observed that *Australians do not take things too personally and they are often very honest about things*. Thus, Australian practitioners tend not to take disagreements about requirements or procedures as a personal affront.

3. Tolerating mistakes: Misunderstanding was a common issue in RE and disrupted the development of software. Practitioners believed that Australian stakeholders were more tolerant of mistakes as long as requirement engineers were honest and admitted their errors. A6 stated that *“from my experience, here they may be more tolerant about mistakes or misunderstanding, as long as you are honest”*.

3.9. Recognition of uncertainty

Uncertainty is inevitable in RE because requirements can be vague, ambiguous, unclear and constantly changing. Seven participants expressed feeling comfortable in situations

which they had not previously experienced (A2, A3, A7, A10, A12, A13, A15). Practitioners deal with uncertainty by asking many questions in various ways. A3 commented that *"I think, in our culture we speak out and we ask and keep asking"*. In the follow-up phase, interviewees agreed that acceptance of uncertainty by continuously asking questions positively affected requirements elicitation, analysis, specification, and change management [✓9]. For example, practitioners continuously asked clients to provide clarification and justification for proposed changes.

In complex software, the uncertainty involved early in RE may expose software implementation to significant risk. One of the responsibilities of requirements engineers is to ask and provide follow-up questions to identify user requirements and distinguish them from business rules, functional requirements, and quality goals [15]. The ability of Australian practitioners to ask questions naturally to manage uncertainty would assist them to provide better modelling decisions and acquire a more comprehensive understanding of users' needs. Thus, this cultural aspect complements the practice of asking many questions. However, Australian practitioners perceive that asking the same question in different ways is an appropriate and accepted way for gaining a deeper understanding of users' needs. In many cultures, asking numerous questions is considered to be impolite and unacceptable, and non-Australian practitioners and stakeholders may need to train themselves to ask/respond too many questions.

3.10. Taking ownership and responsibility

Taking responsibility affects the success of the RE process [12]. Hofstede et al. [11] argue that people in cultures like Australia tend to be self-reliant and responsible for their choices. Seven interviewees emphasised that if a task was assigned to them, the practitioner would take responsibility to deliver (A2, A3, A5, A7, A11, A13, A14). A3 stated that *"it is my concern. I own it. I report back to a project manager and I tell them what is going on"*. Further, requirement engineers would take the initiative to correct domain experts' misconceptions. Three practitioners stated that if the domain experts' decision was wrong, they would not hesitate to correct them, even if they were in positions of authority (A10, A11, A12). A11 stated that *"I am not afraid to tell them that this is wrong"*. The importance of this cultural aspect was that requirements engineers would take responsibility for solving problems and delivering the solutions. The follow-up participants agreed that taking ownership positively influenced the whole RE process [✓8].

Taking ownership helps to establish trust among software stakeholders and is conducive to successful RE outcomes. Ramesh et al. [12] found that software practitioners were reluctant to take ownership of tasks because they were worried about the potential risks of having to take responsibility for something going wrong. Consequently, the willingness of Australian practitioners to take ownership complement RE practices, thereby increasing the chance of a successful outcome of the RE process. As the trust element is important to Australian stakeholders, and they are tolerant of mistakes, it is crucial for practitioners to be able to take responsibility and actively contribute to meet users' needs without being afraid of being wrong.

3.11. Collaborative engagement and decision-making

Stakeholders' involvement is a key component of the RE process to precisely identify and understand their needs. Nine interviewees stated that the decision of what requirements that should be implemented was shared among stakeholders (A2, A3, A5, A6, A7, A8, A11, A12, A14).

The positive effect was that every stakeholder was involved during the RE phase. On the customer side, managers consulted the domain experts and requested feedback and insight from them, especially prior to signing off on the contract. A8 expressed that *"usually customers will have a project manager talk to you, and at the really close to signing stage, they will get more technical people start talking to you"*. Also, the requirements engineer might be asked to demonstrate the effectiveness of their solutions

in order to sign off on the contract. In this regard, practitioners believed that “*we need to convince the domain expert*” first because the managers signed off based on the domain expert’s opinion (A10). However, managers always held the final decision for approval because, as mentioned by practitioners, it was the manager’s responsibility to handle the financial side of the project. On the software team side, practitioners reviewed progress and requirements models, and discussed issues daily and collaboratively.

The negative effect was that during workshops, a domain expert might dominate the session (A5, A6, A13). Because “*Australian client generally thinks that he has as much right as anybody else to express his opinion*” (A5), a domain expert may talk over the top of others, which made it difficult to manage the workshops. In the follow-up, practitioners agreed that collaborative engagement had a positive impact on the RE process [✓10] since it helped clients to increase the effectiveness of the solutions by integrating multiple points of view. Also, they agreed that requirements elicitation and validation activities might be negatively affected by a person dominating the sessions [X4]. Hence, practitioners need to make sure that users can voice their opinions and that sessions are managed professionally.

3.12. Loose employment of RE practices

Team commitment to the RE process produced better outcomes [15]. Five interviewees emphasised that they had some flexibility or freedom to use their own approach to elicit or model users’ requirements (A5, A10, A11, A14, A16). Even though the practitioners adopted a waterfall or agile method, they did not strictly follow the adopted method step-by-step. As explained by A14, “*we do not have this strict methodology to follow*”. Practitioners might skip some details in documenting the requirements or skip some RE practices (e.g., reviewing specifications or tracking changes).

The positive effect of this cultural characteristic was that practitioners were more welcoming of newly introduced RE practices or tools. Practitioners explained to the team the reasons for and benefits of using the new tools in order to seek their opinion and approval. A11 declared that “*I just explain my reasons why I say this is, what is happening, and then he [team leader] usually say go ahead and do it*”. For example, when JIRA was introduced as a tool to manage the requirements, they easily accepted and replaced Excel. Further, clients might request that a certain process be followed to make sure that the risk inherent in the software implementation was low enough to proceed. For example, clients might request a series of reviews such as “*system requirements review, system definition review, preliminary design review, detail design review, training readiness review*” (A9). In the follow-up, interviewees agreed that accepting new RE tools/practice positively influenced requirement analysis and change management [✓5].

The negative effect of this aspect was that practitioners compromised the task by taking shortcuts to achieve the desired results. Practitioners take short cuts by not do strictly follow the procedure required to complete the task. A10 believed that “*here in Australia, we always take shortcuts*”. One interviewee admitted that “*if the task was to implement a framework that required to create three more steps to properly model the software architectural, they simple did not do it*”, which weakened the solution (A11). Six interviewees agreed that shortcuts negatively influenced all RE activities [X6].

One of the best practices is to define the RE process [15]. This provides practitioners with guidelines enabling them to consistently apply RE procedures and facilitate the planning of cost, schedule and resources required for a project. However, loose application of RE practices impedes the RE process. It might also expose the company to higher risk and increase the developers’ misunderstanding of users’ needs.

3.13. Aiming for quick results

In some cultures, people believe that efforts should focus on producing quick results [12]. Five interviewees expressed that clients sometimes wanted to see more working solutions quickly (A3, A8, A12, A14, A15). The implication of this cultural aspect was that clients often set short-term and unrealistic targets. A3 and A8 expressed that clients might ask

“how quickly can you do the design?” or *“could you do it quicker, less time”*. The issue was that clients *“do not think, this is our software 2 years vision; let us start developing this solution for this 2 years vision”*, instead, they think in terms of what they want by next spring or in the next phase. A14 believed that quick results were required because *“the market is demanding much shorter”* time and working solutions to generate profit.

In the follow-up phase, nine participants agreed that aiming for quick results affects the RE process. Five participants agreed that it had a negative effect on requirements elicitation, analysis and change management [X5] because requirements were not clearly defined and only covered business requirements, not functional requirements. On the other hand, practitioners also believed that aiming for a quick result had a positive impact on requirements elicitation and validation as it encouraged clients to quickly define and approve the requirements [✓4].

One of the benefits of agile RE is frequent releases and speedy delivery. Aiming quick results might complement agile RE. It will assist Australian software stakeholders to move closer to the solution by providing early results, which increase customer satisfaction. Practitioners may then need to be aware of the need to continually plan to manage frequent changes in requirements, and the potential risk might counter with aiming quick results.

4. Threats to validity

A number of factors could have affected our collected data and analysis. Firstly, the selection of practitioners might affect the study. To address this issue, we adopted the purposive method, applying strict criteria to the selection of participants. The 16 practitioners were carefully selected with the aim of acquiring a broad section of Australian practitioners who have been working in Australia for several years. Secondly, participants might avoid answering some questions because of the sensitive nature of this research. To mitigate this, participants were guaranteed that data would be treated anonymously under ethical approval. For generalisation, we targeted as great a variety of samples as possible in regard to roles, experiences, company size, and client type. Also, we evaluated and generalised our findings using follow-up interviews.

Thirdly, we were concerned that cultural bias might affect our data analysis and interpretation. We addressed this issue by collecting the data from 16 practitioners working in 16 different organisations and having a wide range of experience. We also applied thematic analysis to report only the dominant aspect/themes within the data, validated by follow-up interviews. In some cases, organisational culture (in addition to the national culture) might also affect RE activities. We addressed this issue by formulating the interview question to address the influence of national culture in RE activities and explain the purpose of the research at the beginning of each interview. We tried to mitigate this threat to validity by having participants from different companies that vary in their number of employees. Finally, the data presented in this paper reflects the interviewees' opinions and perceptions of culture-related issues. However, some of the identified cultural characteristics might be general issues affecting RE activities, which can be identified within any culture albeit to different extents. An example of this is managers' influence.

5. Discussion and Conclusions

Our findings were derived from a mixed-method study consisting of 16 in-depth interviews with Australian software practitioners. Table 2 summarises the cultural characteristics and their impact on RE activities. 8 of the 13 characteristics could negatively affect the RE process, possibly resulting in software development failure. Negative factors such as hidden agendas, managers' influence, and solution-focused requirements are found on the customer side. These factors are common to Australian customers and Australian practitioners have to take them into account as they directly influence the effectiveness of RE outcomes such as user satisfaction, understanding users' requirements, requirements' completeness, and software quality.

Table 2. Influence of Australian culture on RE activities

Cultural Aspects	RE Activities					Affect
	Elicitation	Analysis	Specification	Validation	Management	
Hidden agenda	✓	✓		✓	✓	Negative
Resistance to accepting changes	✓			✓	✓	Negative
Managers' influence	✓		✓	✓	✓	Negative
Solution-focused requirements	✓		✓	✓	✓	Negative
Australian English	✓					Negative
Solving conflicts by compromising	✓			✓	✓	Positive
Establish trust	✓			✓	✓	Positive
Recognition of uncertainty	✓	✓	✓		✓	Positive
Openness and Honesty	✓			✓	✓	Positive
Taking ownership and responsibility	✓	✓	✓	✓	✓	Positive
Collaborative engagement	✓	✓		✓		Negative/Positive
Loose employment of RE practices	✓	✓	✓	✓	✓	Negative/Positive
Targeting quick results	✓	✓		✓	✓	Negative/Positive

Our study also demonstrated that Australian practitioners seem to violate the RE process by neglecting some practices. Although, it works well for them, this culture-specific behaviour might lead to challenges in the case of multicultural teams, especially within Global Software Development (GSD). Ayed et al. [3] compared the behaviours of Malaysian and Belgian software teams and found that the majority of Malaysian software developers followed the process guidelines as closely as possible, whereas Belgian teams violated the process by neglecting some practices, which was perceived as having a negative effect on agile practices. Thus, flexibility in applying RE practices would not be a problem for Australian and Belgian practitioners, in contrast to Malaysian practitioners, which should be taken into account in the case of multicultural and/or geographically distributed teams. This also highlights that it is crucial in GSD to discuss the RE process, the dependencies of each RE activity and its associated artefact from the beginning of software development in order to avoid process misalignment, delays, and conflicts.

Our study also demonstrates that the implementation of the RE process without considering the role of individuals' cultures is likely to prevent practitioners from achieving effective outcomes. Our results show that not all RE practices will produce successful outcomes in Australia due to cultural influences. For example, hidden agendas, managerial' influence, and user resistance directly affect negotiations and prioritisation. On the other hand, we noticed that RE practices can align naturally with some cultural aspects such as the taking of ownership.

The growth of GSD encourages requirements engineers to collaborate in order to accommodate cultural, geographical and temporal differences. In the case of GSD, taking cultural characteristics into account is especially important. In the case of Australian stakeholders, we discovered that cultural aspects such as collaborative engagement, openness, and trust facilitate stakeholders' involvement and help RE practitioners to elicit their requirements. In contrast, Thanasankit [13] found that face-saving, social hierarchy, and the need to show respect negatively affect user involvement in Thai culture. Thus, identifying these cultural idiosyncrasies might help to improve RE practices, outcomes, and collaboration, particularly for GSD.

Culture is recognised as an essential factor influencing the development and deployment of a software system. However, there is a lack of research exploring the influence of culture on RE activities [14], despite the increase of GSD and the diversity of

workplaces. Our findings demonstrate that understanding the influence of culture on RE activities would result in better adoption of RE practices. Our study contributes to this literature by identifying the cultural factors that influence RE activists, analysing their effect on how these factors might impede or complement the application of RE practices and proposing solutions to address the problems.

Future work: We intend to pursue three research directions: (1) replicating the study to cover other cultures and compare results, (2) building a framework describing the influence of culture on RE activities, and (3) analysing how/whether organisation culture affects RE activities, in addition to the influences of a national culture. The framework will help requirements engineers to improve RE practices, to be aware of potential cultural issues, and to overcome these issues effectively.

References

1. Alsanoosy, T., Spichkova, M., Harland, J.: Cultural Influences on Requirements Engineering Process in the Context of Saudi Arabia. In: 13th Int. Conf. on Evaluation of Novel Approaches to Software Engineering. pp. 159–168. SciTePress (2018)
2. Alsanoosy, T., Spichkova, M., Harland, J.: Cultural influences on the requirements engineering process: Lessons learned from practice. In: 23rd Int. Conf. on Engineering of Complex Computer Systems. pp. 61–70. IEEE (2018)
3. Ayed, H., Vanderose, B., Habra, N.: Agile Cultural Challenges in Europe and Asia: Insights from Practitioners. In: ICSE-SEIP. pp. 153–162. IEEE (2017)
4. Bano, M., Zowghi, D.: A systematic review on the relationship between user involvement and system success. *Information and Software Technology* 58, 148–169 (2015)
5. Blaikie, N.: *Analyzing quantitative data: From description to explanation*. Sage (2003)
6. Braun, V., Clarke, V.: Using thematic analysis in psychology. *Qualitative research in psychology* 3(2), 77–101 (2006)
7. Creswell, J.W.: *Educational research: Planning, conducting, and evaluating quantitative*. Prentice Hall Upper Saddle River (2002)
8. Damian, D.E., Zowghi, D.: RE challenges in multi-site software development organisations. *Requirements Engineering* 8(3), 149–160 (2003)
9. Easterbrook, S., Singer, J., Storey, M.A., Damian, D.: Selecting empirical methods for software engineering research. In: *Guide to advanced empirical software engineering*, pp. 285–311. Springer (2008)
10. Guest, G., Bunce, A., Johnson, L.: How many interviews are enough? An experiment with data saturation and variability. *Field methods* 18(1), 59–82 (2006)
11. Hofstede, G., Hofstede, G.J., Minkov, M.: *Cultures and Organizations - Software of the Mind: Intercultural Cooperation and its Importance for Survival*. McGraw-Hill (2010)
12. Ramesh, B., Cao, L., Kim, J., Mohan, K., James, T.L.: Conflicts and complements between eastern cultures and agile methods: an empirical investigation. *European Journal of Information Systems* 26(2), 206–235 (2017)
13. Thanasankit, T.: Requirements engineering – exploring the influence of power and Thai values. *European Journal of Information Systems* 11(2), 128–141 (2002)
14. Tuunanen, T., Kuo, I.T.: The effect of culture on requirements: a value-based view of prioritization. *European Journal of Information Systems* 24(3), 295–313 (2015)
15. Wiegers, K., Beatty, J.: *Software requirements*. Pearson Education (2013)
16. Yin, R.K.: *Case study research: Design and methods*. Sage publications (2013)