What Practitioners Think of Inter-Organizational ERP Requirements Engineering Practices: Focus Group Results

Maya Daneva, University of Twente, The Netherlands

Niv Ahituv, Tel-Aviv University, Israel

ABSTRACT

Empirical studies on requirements engineering for inter-organizational enterprise resource planning (ERP) systems have demonstrated that the ERP vendor-provided prescriptive models for ERP roll-outs make tacit assumptions about the ERP adopter's context. This, in turn, leads to the implementation of suboptimal solutions. Specifically, these models assume that ERP implementations happen within a single company, and so they pay only scant attention to the stakeholders' requirements for inter-organizational coordination. Given this backdrop, the first author proposed 13 practices for engineering the ERP coordination requirements in previous publications. This paper reports a confirmatory study evaluating those practices. Using an online focus group, the authors collected and analyzed practitioners' feedback and their experiences to understand the extent to which the proposed practices are indeed observable. The study indicated very low variability in practitioners' perceptions regarding 12 of the 13 practices, and considerable variability in their perceptions regarding the role of modeling inter-organizational coordination requirements. The contribution of the study is twofold: (1) it adds to the body of knowledge in the sub-area of RE for ERP; and (2) it adds to the practice of using qualitative research methods in empirical RE.

Keywords: *Empirical Software Engineering, Enterprise Resource Planning, Focus Group Research, Qualitative Research Methods, Requirements Engineering*

INTRODUCTION

The elicitation, documentation, and negotiation of the requirements for systems based on ERP software packages have formed an important sub-area of Requirements Engineering (RE) in the last decade (Daneva & Wieringa, 2010). ERP solutions are, more often than not, large and multi-component systems that provide cross-functional services to a business. They often impact data semantics and business processes across more than one functional area of an

DOI: 10.4018/jismd.2011070103

organization. This sub-area of RE is becoming even more important, as ERP solutions are increasingly responding to the reality of modern companies networking with others to form inter-firm partnerships (also called 'extended enterprises'). For such companies, the use of ERP is a central component of their strategy for the proper management, coordination, and control of inter-organizational relationships (Nicolaou, 2008). An inter-firm partnership is a business collaboration composed of multiple companies or business units, which together accomplish the mission of bringing a product or service to market. Engineering the coordination requirements for an inter-organizational ERP solution to support an inter-firm partnership is, however, a difficult task. The current RE approaches to ERP are based on prescriptive models that are provided by ERP vendors and their implementation partners (Ahituv et al., 2002). These models do not explicitly draw on practices perceived as useful from the standpoint of the stakeholders in the ERP-adopting organizations that have formed a partnership. A 2010 survey by Daneva and Wieringa (2010) on state-of-the-art ERP RE approaches reveals that, while the prescriptive RE models explicitly address business process, data, and interface requirements, they tacitly assume a project environment where an ERP package is implemented within the walls of one organization. As a result, only scant attention is paid to the requirements for inter-organizational coordination that stakeholders expect the ERP solution to meet. This, in turn, leads to the implementation of systems that are suboptimal from the perspective of some stakeholders, as the resulting ERP requirements definitions lack an explicit part on what the solution-to-be should do to properly support the inter-firm partnership's needs and intentions for inter-organizational coordination and collaboration. Many inter-firm partnerships therefore seek to extend the vendor-provided RE models by adding practices that address the requirements for inter-organizational coordination (Daneva & Wieringa, 2010). In the inter-organizational context, the solution-to-be may well include diverse ERP configurations, each of which matches the needs and intentions of a particular partner, which, in turn, implies the presence of coordination mechanisms unique to each configuration. Companies therefore justifiably assume that, if they identify, document, and validate their needs and intentions for ERP-supported coordination early enough, it is more likely that the right ERP-solution will be delivered to them (Prakash, 2010).

In our earlier research by the first author (Daneva & Wieringa, 2006b; Daneva 2010), we investigated the following issues: (1) how to engineer the requirements for inter-organizational coordination in ERP projects; and (2) what constitutes good engineering practices with respect to the coordination requirements for shared ERP solutions. This research was accomplished by reviewing the published literature; specifically, case studies representing the experiences of a broad array of companies that had implemented inter-organizational ERP solutions in the past 15 years. We found that the coordination among companies in an extended enterprise takes place at four different levels of complexity. Considering these levels, we proposed 13 RE practices, along with an early indication of the benefits that can be expected from introducing each RE practice in an extended enterprise. While in our earlier publications (Daneva & Wieringa, 2006b; Daneva 2010), we reported on our motivation to search for the RE practices and on the research process that helped us derive them, in this paper, we focus on the need to evaluate them. Specifically, our goal is to carry out an initial evaluation of the practices based on ERP practitioners' feedback. This paper provides a detailed account of how we used an asynchronous online focus group approach to do this. This study represents the first step of the many we have planned to empirically evaluate RE practices.

The research presented in this paper contributes to the body of knowledge in RE for ERP in two ways. First, we are adding to the literature in RE for ERP, by making RE knowledge explicit and providing information on which practice works in what context, and providing evidence suggesting that 12 of the 13 proposed practices

for coordination requirements make sense for practitioners and can perhaps be considered good candidates for inclusion in RE process models for inter-organizational ERP projects.

Second, we are adding to the body of empirical software engineering (SE) studies in general, and to the body of empirical studies in RE in particular. This contribution is twofold: (1) we directly respond to the call (Sjøberg et al., 2007) of the empirical SE community for more empirical research on which SE process to use in what specific context. We also respond to the particular call (Cheng & Atlee, 2007) of the RE community for more empirical research in the sub-areas of RE. The existing literature on empirical SE provides very little guidance on the practical steps of using focus groups to evaluate good SE practices (and RE practices in particular). Kontio et al. (2004) and Lehtola et al. (2004) have published three focus group studies on RE topics, these authors being among the very few who have ever used the focus group research method in the field of RE and who have also provided guidelines (Kontio et al., 2008) for using focus groups in empirical SE. We therefore reflect on our focus group-based validation experiences and distill from them some lessons learned about the strengths and weaknesses of using focus groups as a research approach, hoping it will be of value to the research community.

In the following narrative, we first present related work on judging SE practices. We then provide the theoretical and empirical background of our study and describe our focus group plan, along with the justification for the decisions about the way in which we set up our focus group process. We then report on our focus group execution and its outcomes. Lastly, we discuss the results and limitations of the study, reflect on our experiences, and present our future research activities.

RELATED WORK

Below, we review the published literature sources on two topics: (1) the ways in which SE practices are judged in general; and (2) the approaches that have been used in empirical SE to evaluate the validity of specific practices that have been deemed 'good' or 'best' in a specific SE sub-area (e.g. RE).

The topic of judging practices as good or best in SE has been treated in almost all SE sub-disciplines, for example RE (Sommerville & Sawyer, 1997; Beecham et al., 2005; Schoemaker, 2007), software modeling (Le Gloahec et al., 2008), portfolio management (Jeffery & Leliveld, 2004), software testing (Chilarege, 1999; Kaner et al., 2001), software project management (Brown et al., 2000), software maintenance (April & Abran, 2008), and software estimation (Jones, 2007). This topic has also been treated from the perspective of specific paradigms (e.g. agile SE, object-oriented software development, component-based software development), and of specific application areas (e.g. global software development, cloud computing, outsourcing, service-oriented architecture, business process redesign (Mansar et al., 2010). SE authors search for good practices from a variety of sources, including research papers, experience reports, guides, standards, books, and company-specific repositories (Fraser et al., 2007). We think that it is not surprising that the volume of literature on this topic is remarkably large, because the software industry is well aware that the capacity of the enterprise to prosper is based on its ability to capture, use, and address good practices (Fraser et al., 2007; Jones, 2009). We must note, however, that, while the literature sources that we referred to in this paragraph did propose specific packages of practices which the authors deemed good or best in their respective sub-areas of study (e.g. RE), only a relatively small minority of these proposals was subjected to a systematic evaluation regarding the validity of the claims that the authors made about the practices in the proposals. In these published sources, we observe that there is agreement among almost all authors that a practice labeled 'good' or 'best' is one that successful organizations tend to use frequently in their projects. The premise that the authors use in judging these practices is an

understanding that successful software (or IT) projects follow sound engineering principles, while failing projects do not. We have observed, however, that, despite the continual effort of the SE community to reflect on SE excellence and best practices by using well-founded quantitative analyses (Jones 2009), at the present time, for the majority of practices deemed good or best, the good practice status (or best practice status) has been assigned based exclusively on anecdotal evidence in successful software organizations. For the majority of the practices proposed in the cited sources, there is no statistically representative evidence of the 'goodness' of the practices in question. This is especially true for SE sub-areas with a relatively short history (e.g. agile SE, cloud computing), and also for RE, which has existed as a separate sub-discipline for 15-20 years.

Our review also reveals that there is no agreement on what a 'valid' practice is, or on what 'validity' means and how to demonstrate it. As we will see in the remainder of this section, researchers have used a variety of definitions of validity, each serving the purpose of a specific study. Validity has also been approached by using a variety of research techniques, ranging from quantitative (Basili et al., 1992; Jones, 2009) to qualitative e.g. Sommerville & Sawyer, 1997; Fraser et al., 2007). This variety of definitions and approaches to the validity of SE practices is not surprising, because, as von Wangenheimer et al. (2010) indicate, at the present time there is little methodological support for how to systematically plan and execute the validation of practices in particular, and of maturity models (i.e. the collections of SE practices) in general. In their recently published systematic review of the empirical evaluation of maturity models (von Wangenheimer et al., 2010), these authors found very few studies that report on the possible effects of practices on the intended quality and performance goals.

Because we wanted to review examples of studies that explicitly deal with the validation/evaluation of SE practice, we had to complete a narrower search of published literature. We deliberately chose to look into four specific groups of sources that not only make proposals for packages of good/best SE practices (as the authors of many of the previously mentioned references had done), but also describe, in more detail, the analytical arguments that practitioners used to substantiate their conclusions about what represents a 'good' or a best practice. These groups of sources include examples of authors who placed SE excellence on a sound quantitative basis (Basili et al., 1992, Jones, 2009), and also of authors who have carried out systematic qualitative evaluation studies on the validity of SE practices:

(1) The literature on maturity models in SE, because these models represent a "vast body of knowledge about good software practices" (von Wangenheim et al., 2010) and possibly explain the justification for what practices to include in a model and why (El-Emam & Jung, 2001);
(2) The literature on the deployment of the experience factory approach (Basili et al., 1992, Basili, 1995, Boehm et al., 2005) in organizations, because this approach is one of the earliest key vehicles proposed by the empirical SE community to enable evolutionary learning from organizational experience;
(3) The literature on lessons learned (Schneider et al., 2002; Fraser et al., 2007; Jones, 2009) in SE, because leveraging these lessons is a well-known common sense approach in software companies where good practice is distilled to enable its reuse; and
(4) The literature on the results (Jones, 2000) of the efforts of software practice benchmarking communities and industry peer networks (Sgourev & Zuckerman, 2006), because they are actively involved in the definition and dissemination of good, as well as innovative, practices.

Our review of these studies suggests that, in most of them, the authors seek to demonstrate or evaluate a possible relationship between the uses of one or more practices on the one hand, and some important project or process outcomes

on the other, e.g. reduced cost, improved client satisfaction, increased quality, and reduced rework. Furthermore, we observe that the degree to which the authors present their research on this relationship transparently and comprehensibly (e.g. in such a way that other researchers could replicate the published study in new contexts) vary widely. This observation agrees with von Wangenheim et al. (2010), who found that very few practices were evaluated as part of a maturity model validation effort, and whatever evaluation took place was through expert reviews with "varying degree of participation."

Below, we summarize, in chronological order, those previously published approaches to validity evaluation of software practices that provide much detail on how the authors' conclusions about validity are substantiated.

Basili et al. (1992) were among the very first who sought to demonstrate a connection between the incremental adoption of learning experiences (these are good practices) in an organization and important project outcomes (namely, cost per line of new code, reliability, "manageability", and effort expended in rework). The conclusions of these authors regarding the impact of good practices have been substantiated through numerous experimental studies carried out in their respective organizations: NASA, the University of Maryland, and the Computer Sciences Corporation.

Jones (2000, 2009) has been using benchmark studies to derive and evaluate best SE practices pertaining to a number of critical SE sub-fields. The benchmark datasets on which Jones's analysis relies contain quantitative data, which are structured according to application type and application size, and collected across software projects in numerous organizations, in a variety of business sectors, and in 24 countries. His evaluation is based on statistical techniques, as well as on comparative analysis techniques that help to quantitatively demonstrate the relative superiority of a specific practice over other practices in an SE sub-area. (We note that the author and his colleagues have been in the software benchmarking business since 1985, working exclusively on quantitative indicators for managing software projects and processes, as well as improving software products.) An important, and unique, aspect of Jones's evaluation on best practice is his definition of specific criteria for including or excluding tools and technologies from best practice status. For example, the author explicitly recommends that any technology considered a potential best practice needs empirical results from at least 10 companies and 50 projects.

El-Emam and Jung (2001) carried out a questionnaire-based survey among software process maturity assessors to validate the SPICE (Software Process Improvement and Capability Determination) model. Their study draws on the accumulated experiences of assessors, while carrying out SPICE trials. The objective of the study was "to determine how good the model is, whether it was useable, useful, whether the rating scheme was meaningful, and whether there were general weaknesses in its architecture."

Jeffery and Leliveld (2004) used an online survey complemented with in-depth interviews to evaluate software portfolio management practices and the maturity levels with which they are associated. The survey data were used to test hypotheses regarding the relationship between relative organizational performance gains and the use of best practices in project portfolio management. The interviews were used to formulate the characteristics of the maturity levels of the author's model.

Beecham et al. (2005) aimed to demonstrate the suitability of RE practices for inclusion in an RE maturity model, and devised a RE-practice validation approach that deployed multiple research techniques, namely an expert panel and a survey. These authors formed a group of 23 experts (which was deemed to be representative of the population of experts in CMM and RE), and then ran a survey-based process to judge how well an RE good practice model met a set of predefined criteria for success. The authors' conclusion was that the range of responses by the experts "formed a good basis for the researchers to gauge how their model might be viewed in practice."

The combination of an expert panel and a survey was also the approach used by Ramasubbu et al. (2005) to validate practices for managing distributed software development. These practices formed key process areas and were meant as an extension of the CMM for the global development context. Like Beecham et al. (2005), Ramasubbu et al. (2005) used the survey data to run statistical techniques and obtain sound results that substantiate their claims.

Mansar and Reijers (2005) presented an approach that used two empirical research techniques, a case study and a survey, in the validation of the best practices for business process redesign projects. In this study, the concept of validity was defined in a range of terms, namely duration, flexibility, quality, productivity, and cost. Using these, the authors referred to: (1) criteria the practices have to meet (e.g. relevance to practitioners); and (2) specific impacts of the practices on project outcomes. The case study technique was applied to evaluate the relevance of the best practices and the extent of their applicability. The survey was used to validate the impact of the best practices as perceived by practitioners. The survey data served as quantitative input to test two hypotheses referring to whether or not "the practices cover all possible aspects practitioners look for," and whether or not "the practices are indeed applied extensively by practitioners" (Mansard & Reijers, 2005). The authors wanted to find out how much practitioners focus on a practice while they are redesigning a business process.

Abba et al. (2009) used a factor analysis-driven approach to evaluate the effectiveness of 58 agile practices for the purpose of forming a guide for agile process improvement. Their goal was to provide assistance to practitioners in choosing the right combination of agile practices based on company-specific needs. The research approach these authors used consisted of: (1) a survey, as the quantitative data collection method; and (2) factor analysis (Field, 2005), as the technique to help explain the maximum amount of common variance in a correlation matrix using the smallest number of explanatory concepts. Factor analysis also formed the core of the research approach of So and Scholl (2009), who investigated the social-psychological effects of 8 agile SE practices.

THEORETICAL AND EMPIRICAL BACKGROUND

As indicated in the Introduction, the overall objective of this study is to evaluate ERP RE practices from the perspective of practicing ERP professionals. This section provides background on these practices, on the concept of validity we have used, and on the overall research approach chosen. The purpose of the section is to help the readers understand the rest of the paper and to avoid any misunderstandings.

The Object of Study: Practices for Inter-Organizational Coordination Requirements

The object of study in this paper is a package of 13 practices for engineering the coordination requirements in an inter-organizational ERP project. For the purposes of our research, we call 'coordination requirements' those requirements that are concerned with two aspects of the inter-organizational relationships: (1) what partner companies in an extended enterprise share; and (2) how they share it (Daneva & Wieringa, 2006b). Engineering inter-organizational coordination requirements means getting stakeholders from the partner companies to explicitly discuss and document their intentions with respect to (1) and (2). Two characterizing properties of the coordination requirements in an inter-organizational ERP project are: (1) that these requirements be derived from the overall business goal of the extended enterprise; and (2) that they be decided at the "intentional level" (Prakash, 2010), which means that, once the partner companies agree on the intentions of the inter-organizational ERP solution-to-be, they have to ensure that the goals of the individual partners come together to satisfy these intentions. In other words, the goals of the partner organizations must support each other. For example, a number of case studies

on the implementation of inter-organizational ERP in extended enterprises (Champy, 2002; Saliola & Zanfei, 2009; Simatupang, Wright, & Sridharan, 2002; Simatupang, Sandroto, & Lubis, 2004; Xu & Beamon, 2005) refer to the project setting in which a large company forms a collaboration with other companies to achieve the goal of raising the productivity of its supply chain. Typically, this goal is achieved through a transformation of the supply chain based on the integration of the company's suppliers into a shared ERP system. Essentially, in forming the extended enterprise, such a company reframes the way it regards its suppliers: as Champy puts it, "the suppliers are no longer regarded as mere producers of parts but as adders of value to the shared enterprise."

Once all the partner companies commit to collaborating towards achieving this goal, each partnering 'adder of value' has to make decisions regarding, for example, how each partner's processes must change to fit the shared system, and for what benefits. Also, partners more often than not have to adopt a shared terminology and information semantics for those areas of business activity in which they want to do things together. This is key, as, without establishing a common understanding about the meaning of the information to be shared, its content could not be used efficiently and accurately. For the purposes of clarification, we have narrowed down the discussion to one particular case that was cited in the literature, and to which we referred in this section (Champy, 2002). It is the case of Wal-Mart Stores, who formed an extended enterprise with its suppliers and also with its customers. This collaboration allowed Wal-Mart to sell, much more quickly, items that had previously been known to take up a disproportionate amount of space in its stores, such as patio furniture and appliances (Champy, 2002). For the suppliers, this collaboration led to increased sales, and for customers it meant speedier execution of orders. For those suppliers and customers who committed to collaborating with Wal-Mart in a shared enterprise, this collaboration required the customers and the suppliers to develop a much deeper understanding of each other's processes. In certain cases, the customer simply demanded that the suppliers adjust their processes to match those of the customer. In other cases, Wal-Mart and a supplier shared a single process to ensure quality, so it became difficult at times to distinguish who works for which partner organization. This variety of ways to share processes and collaborate towards a shared goal required that the inter-organizational ERP system include a variety of ERP configurations, each matching the coordination intentions of a particular partner (or group of partners). Addressing the inter-organizational coordination requirements (e.g. those in the case of Wal-Mart) as explicitly as possible is important, because they are deemed critical (Champy, 2002; Marcotte, Grabot, & Affonso, 2008) to the successful implementation of the multi-enterprise business model (e.g. value collaboration model, customer-centric network) that coordinates all players in an inter-firm partnership. (For a more detailed description of an example of intentional alignment in inter-organizational systems projects in supply chain management, we refer interested readers to the paper by Prakash, 2010).

In earlier research (Daneva & Wieringa, 2006a), we found that four types of coordination requirements are relevant to partners in an extended enterprise: (1) those that refer to the partners' agreements on the goals and benefits of business coordination; (2) those that are concerned with establishing end-to-end inter-organizational business processes—for example, client order fulfillment processes or product provisioning processes; (3) those that address information semantics (the definition and use of common meanings of key information entities); and (4) those that are concerned with achieving interoperable automated processes and data flows. We also carried out literature studies (Daneva & Wieringa, 2006b; Daneva 2010) that resulted in the identification of 13 practices for engineering these requirements in ERP projects.

Moreover, we also found evidence suggesting that these 13 practices are not applicable to all ERP adopting organizations, and we used

the notion of 'coordination complexity level' to indicate which practice is suitable for what ERP coordination context in an organization. By 'coordination complexity', we mean the extent to which a company participates in an extended enterprise. This term is based on Champy's analysis of the ways in which companies participate in inter-firm partnerships (Champy, 2002). In Daneva and Wieringa (2006b), we defined four levels of coordination complexity, each reflecting how extensively a company lets other companies collaborate in and share its own business processes.

Every level of coordination complexity is characterized by the types of partner companies involved, unique inter-organizational coordination goals, areas of sharing, and the coordination mechanisms used. The notion of coordination level, thus reflects the understanding that the more diverse the business partners in an extended enterprise are, and the larger their number, the greater the coordination challenge (Champy, 2002; Daneva, 2010; Prakash, 2010). Level 1 represents the least challenging coordination scenario, with the least complex alignment requirements (Prakash, 2010), while Levels 2, 3, and 4 progress to increasingly challenging coordination processes and more complex alignment requirements. The levels are defined as follows:

- At Level 1, a company aligns its own processes. The goal of an ERP adopter at this level is to improve internal coordination among departments. No inter-organizational challenges or inter-organizational coordination requirements are addressed at this level (Prakash, 2010).
- At Level 2, an organization aligns its processes along with the processes of one other type of organization. The goal of an ERP adopter at this level is to improve coordination with this type of organization, whether as a client or as a supplier (Daneva 2010).
- At Level 3, a company aligns its processes along with the processes of two other types of organizations. The goal of an ERP adopter at this level is to improve coordination with two more company types, e.g. suppliers and clients (Champy, 2002).
- At Level 4, a company aligns its processes with the processes of organizations of three other types of organizations. The goal of an ERP adopter at this level is to work to improve coordination with three other types of organizations. It is not uncommon for these networks to change the coordination mechanisms in an entire business sector (Babiak, 2009; Holland, Shaw, & Kawalek, 2005).

To help companies make a choice on which of the 13 RE practices to use in their ERP project, we associated each practice with one or more of the above-mentioned levels of coordination complexity. So, we assume that if an ERP-adopting organization is aware of its level of coordination complexity, it would be possible for it to pick up those RE practices suitable for a project that targets the achievement of that particular level of coordination. The RE practices and their relevant levels of coordination complexity are presented in Table 1. We note that there is no one-to-one mapping between practices and levels. This means that a practice can be associated with more than one level of coordination complexity (Daneva, 2010).

Research Questions and Motivation for Choosing the Research Approach

The purpose of our focus group study is to evaluate, from the perspective of ERP practitioners, the 13 practices and their association with specific complexity levels. Our plan also includes the evaluation of our focus group experiences with a view to understanding the limitations of this early validation study itself.

Our focus group study is a confirmatory in nature, and represents an early assessment exercise in which we set out to clarify two questions:

Question 1: *Is what we think of as a good inter-organizational ERP RE practice*

Table 1. The RE practices to be evaluated

RE Practice	Complexity level at which it is appropriate for organizations to use the practice
P1. Define how work is divided among partner companies	2,3,4
P2. For each network partner, document data, processes, and communication channels to be shared and with whom	2,3
P3. Document the values and goals to be shared and with whom	4
P4. Collect enough knowledge about the ERP-supported internal processes before aiming for cooperative ERP scenarios	4
P5. Document what separately kept application data of partner companies will be shared via interfaces to a common ERP system	3
P6. Align what is shared to what is kept separate	4
P7. Discover and document the market-making mechanisms and common learning models for partners to share	3,4
P8. Understand how ERP-supported coordination mechanisms will be used	3
P9. Assess the compatibility of partner companies' values and beliefs	2,3,4
P10. Make a business coordination model	2,3,4
P11. Map the business coordination model to a set of ERP-supported coordination mechanisms	2,3,4
P12. Use the reference architecture for the package provided by the ERP vendor	2,3,4
P13. Validate the coordination models and their execution	2,3,4

something that ERP architects observe in their project realities?

Question 2: *If architects observe a practice, at what complexity level would they place it?*

To answer them, we selected the focus group research method, for the following reasons: (1) it is a suitable technique for an inquiry like ours, e.g. obtaining initial feedback on new concepts and helping to clarify the findings that resulted from using other methods; (2) it is well known for its cost-effectiveness (Kontio et al., 2000), which was essential in this first validity evaluation, as we needed to collect a concentrated set of observations within a short time span and on a limited budget; and (3) the resulting data offer a robust alternative (Massey, 2010) to more traditional survey methods, when the number of participants is less important than a rich investigation of content.

Specifically, our plan was to use an online asynchronous focus group (Gaiser, 1997; Orgad, 2005; Kivits, 2005), which is a focus group organized using Internet resources. We selected the online asynchronous form of focus group because: (1) it is extremely useful when the participants are located in multiple time zones and it is difficult to organize a time for geographically far-flung focus group members to participate synchronously; (2) it provides ready-to-use transcribed data; (3) it is flexible, so that our focus group members in various time zones can contribute when it is most convenient for them; (4) it encourages candid exchanges and reduces issues related to the 'interviewer' effect, as focus group members cannot "see" each other; and (5) it allows members' responses to be lengthier and more measured than does the synchronous mode (Orgad, 2005).

Note that, in addition to the focus group approach, we also considered three other re-

search approaches for obtaining answers to our two research questions. These were the Delphi method, which is based on a panel of experts (Brown, 1968), the online survey method (Simsek & Veiga, 2000), and the in-depth interview approach (King & Horrocks, 2010). We ruled out these three approaches, based on the suggestion of methodologists (Simsek & Veiga, 2000; Morgan, 1997; King & Horrock, 2010; Krueger & Cassey, 2008) that there be a trade-off between the following two criteria when a researcher chooses a research approach: (1) the suitability of the approach to produce the type of data that are appropriate for the purpose of our study; and (2) the estimated costs/efforts to use the approach.

Regarding the first criterion, our starting point was the need to obtain information on a range of views in a short time. Specifically, we needed collective feedback on our proposed package of practices, and we needed this feedback to come from a dialog between the participating practitioners themselves, and not between the researcher and each of the participants individually (which would have been the case with the Delphi approach and the survey method, in which each expert fills out a survey questionnaire, and the case with the in-depth interview approach in which the researcher converses with the experts on a one-on-one basis). We considered it essential to be able to observe the extent and nature of participants' agreements and disagreements regarding the contexts in which our RE practices apply, as these observations would presumably bring us an understanding of the kind of follow-up research that would warrant further efforts. The focus group approach was preferred over both the in-depth interview and the survey approaches, because it relies on group dynamics and helps explore and clarify the participants' views in ways that would be less easily accessible in personal in-depth interviews or in a survey.

Regarding the second criterion, we were conscious of the constraints we faced in terms of available resources. Scheduling, carrying out, and transcribing one-on-one interviews—across time zones and over the phone—would have been a long, coordination-intensive, and prohibitively expensive process. We also note that designing and piloting a survey, as well as engaging a representative sample, would have been challenging in the light of the resource constraints we faced. This is why we had to rule out the survey option, even though this approach would have produced the data we needed.

The Focus Group Research Method

A focus group is a group discussion on a particular topic, which is monitored, facilitated, and recorded by a researcher. It is a way to better understand what people think about an issue, a practice, a product, or a service. Focus groups were first used in the United States before and during World War II to understand how war propaganda broadcast on radio was received. As research procedures, the focus group techniques were widely and systematically refined in the 1950s by R. Merton and his team (Merton, 2005). For the past 40 years, focus groups have been used extensively in business-oriented market and consumer research, as well as in academic business research, in communication studies, and in studies in education, public health, and political science.

The term 'focus group' is derived from the term 'focus group discussion'. In essence, the researcher provides the focus of the discussion, and the data come from the group interaction. This means that the focus group serves both to collect information on a range of ideas and to illuminate variations in perspectives between individuals. Because interaction is at the heart of the focus group method, the researcher is primarily interested in how experts react to each other's statements and points of view, how they build bridges between their different perspectives, and how they build up shared understanding during the discussion. Krueger and Casey (2008) indicate that it is this particular type of interaction that gives the method a high level

of validity, because the thoughts and views that each participant expresses can be confirmed or refuted during the group discussion itself.

As a qualitative research technique, focus groups can serve the purpose of both exploratory and confirmatory studies (Krueger & Casey, 2008; Morgan, 1997). The key steps in the focus group-based research process include the following (Kontio et al., 2008):

1. Defining the research questions related to a research problem,
2. Planning the focus group session,
3. Selecting focus group participants,
4. Executing the session,
5. Analyzing the data, and
6. Reporting the results.

The next section reports on the particular way we implemented these steps.

RUNNING THE FOCUS GROUP RESEARCH PROCESS

The Focus Group Plan

To plan our focus group study, we implemented the guidelines proposed by Krueger and Casey (2008). The decision to follow their approach was made after extensive reading on qualitative research literature, specifically literature which compared focus groups with other qualitative techniques, e.g. surveys and in-depth interviews (Morgan 1996), as well as personal consultation with other fellow researchers.

Our research questions (stated in the previous section) drove our choices in composing the focus group. We conducted it with practicing ERP architects from companies who were interested in exploring similar questions from their companies' perspectives. Our focus group plan included 18 ERP solution architects from four telecommunications services providers, two financial services companies, two retail businesses, and one real estate corporation. We applied a purposive sampling approach to selecting these participants. The focus group members were selected because: (1) they had characteristics in common, which pertained to the topic of the focus group: and (2) they had the potential to offer information-rich experiences. We note that focus groups do not gather to vote or to reach a consensus (Morgan, 1997). The intent is to promote self-disclosure, and that is what we were after in this study. According to (Morgan, 1997), the research procedure we planned to implement is known as 'a participatory focus group'. It collects data through group interaction of people of various backgrounds, but with common professional values and common roles in which they execute their professional duties. We also note that, according to focus group research methodologists (Krueger & Casey, 2008; Morgan, 1997), focus groups are not used to provide statistically generalizable results applicable to all people similar to the practitioners in a specific study. The intention of the focus group is not to infer, but to understand, and not to generalize, but to determine a possible range of views. Therefore, in this study we will adopt, based on the methodologists' recommendations, the criterion of transferability as a useful measure of validity. Transferability requires that the results be presented in such a way that allows other researchers to evaluate whether or not the findings apply to their research context.

All 18 ERP architects had the following characteristics:

- They were all in charge of inter-organizational projects that had stakeholders and users at locations distributed in at least four Canadian provinces, namely Quebec, Ontario, Alberta, and British Columbia.
- Each architect: (1) has at least six years of experience in inter-organizational ERP RE; (2) is familiar with inter-organizational coordination issues; and (3) has made proposals to improve his/her company's ERP RE process.
- Thirteen architects have experience with the SAP's ERP package only. One architect has experience in Oracle only. Two architects have experience with SAP and

Peoplesoft, and the other two with SAP and Oracle.
- Five architects had been working in Coordination Complexity Level 2 organizations, eleven architects were employed by Level 3 ERP adopters, and two architects were working for Level 4 ERP adopters.

All architects were known to the first author, as she had worked with them on a professional basis from 1995 to 2004. (Note that the first author worked as an SAP process analyst in a large company in North America prior to joining the university.) As recommended by Krueger and Casey, 2008, the moderator (in this case, the researcher) "should be similar to the respondents," meaning from the same population. Using purposive sampling, the first author chose the focus group members, based on her knowledge of their typicality. The author chose them from among a large group of colleagues based on her judgment as to whether or not they met the requirement that they be professionals with "the greatest amount of insights on the topic," as Krueger and Casey (2008) recommend.

Deciding on the level of moderator involvement in the focus group discussion is the second important design choice next to the choices related to group composition. In our focus group plan, the definition of the role of the moderator was driven by the research questions and the purpose of our study. We planned our focus group to be a structured one with regard to the questions being asked during the session, which means that the moderator was the one to control what topics would be discussed and in what order.

However, we chose to keep our focus group much less structured with respect to the moderator's involvement, in terms of the way in which the participants interacted. This means that the moderator adopted a passive role, and let the practitioners develop the discussion. To achieve this: (1) we set up policies for responding to the participants' messages, communicated the policies up-front, and made sure that the participants were well aware of them; and (2) we specified that the moderator would intervene in the discussion only if a participant violated these policies. This setup is also known as a 'self-managed' focus group (Morgan, 1997), and we opted for it because it served the purpose of the study well, which was to collect feedback on specific RE practices (i.e. the practices associated with engineering the coordination requirements) in a specific project context (in our case, inter-organizational ERP).

The Execution

The focus group members were contacted on a personal basis by the first author using e-mail. Before opening the discussion, this researcher provided the background of the study and presented the 13 practices as a checklist. The focus group members then worked in two stages, dealing with one research question at each stage. This was to ensure that the group members were not overwhelmed with a long list of inquiries at the start of the process.

In executing the focus group process, the first author served as the moderator. Her responsibility was to review the feedback of the participants, to probe deeper when necessary, and to paraphrase participants' points to ensure that misunderstandings were avoided. This researcher made sure that everyone had a chance to express themselves, but without pressuring any expert to write when they were not willing to do so.

Once the data were collected, preliminary analysis was undertaken immediately. This included reading the transcribed online conversations and applying a procedure for ensuring the quality of the collected evidence. This procedure consisted of four steps, as recommended in (Krueger & Casey, 2008), and was designed to pose the following questions while each answer was read by a focus group member:

Step 1. Did the ERP architect directly address the question being asked? If so, proceed to Step 3. If not, go to Step 2. If the answer to this question is unclear, mark the text with red and review it later.

Step 2. Did the ERP architect address a different question in the focus group? If so, move the text fragment to the question it addresses. If not, go to Step 3.

Step 3. Does the ERP architect's comment say anything important about the topic? If so, move it to the related question. If not, mark it with a label 'set aside'.

Step 4. Does this comment say something that had already been said earlier? If so, add this text fragment to the stack of similar quotes. If not, start a separate stack.

Reiterating this procedure meant sifting through the data and sorting out quotes that provide evidence of the presence of each practice in the practitioner's observations. The information was then sorted in a way that made sense in relation to the two research questions. We describe the data analysis in more detail in the next section.

Data Analysis and Outcomes: Stage 1

In the first stage, the architects were asked to review the checklists and mark those practices that they either used personally, or witnessed someone else on their RE team using, in the early stages of their ERP projects. Specifically, the researcher asked each architect to provide one of the following types of evidence regarding the use of a practice:

(1) An example of the practice being used in a project, and the context details that help reveal the presence of a practice, or
(2) A brief explanation of exactly how the practice worked; this was to make sure that the researcher understood that the practice was indeed 'practiced' during a project, and had received convincing evidence of that fact.

The feedback of the focus group members took the form of story-telling, and provided transcribed conversations in which they shared their experiences. An example of a transcribed textual fragment by three focus group members regarding practice P5 is presented in Table 2. The grayed text in the second column of Table 2 identifies quotes that are similar across focus group members. These similarities are marked with codes (see the third column). The codes were instrumental in navigating through the transcribed conversations and identifying similar text fragments.

The responses of the 18 ERP architects are summarized in Table 3. For each practice, we report the number of architects who observed it at least once in a real-life setting. Table 3 indicates that 12 of the 13 practices make sense to practitioners, and were actually observed in real-life projects.

Table 3 shows that five practices, namely P1, P5, P6, P8, and P12, were observed by all 18 focus group members. Four other practices (P2, P3, P9, and P 13) were observed by at least 9 of the 18 focus group members. Two practices (P4 and P11) were observed by 8 and by 6 of 18 focus group members respectively. One practice (P7, Table 3) was not observed at all, but the architects attributed this to the fact that this practice referred to coordination with intermediaries, and no focus group member had worked on a project with an intermediary business.

Data Analysis and Outcomes: Stage 2

In the second stage, we excluded the practice that no one had observed (P7, Table 3). We randomly sorted the list of 12 remaining practices and asked the architects to position them at the four coordination complexity levels. We then compared how the architects associated the practices with the levels and how we (the researchers) did so (Table 4). For each practice, we assessed its mapping to a complexity level by using the percentage occurrences of those architects' rankings that coincided with ours (Table 4). We adopted a cut-off of 75% as an acceptable matching level, as recommended in previous validation studies of SE practices (Krishnan et al., 2005; Ramasabbu et al., 2005). The data in Table 4 suggest that our mappings

Table 2. Text transcribed during stage 1: practice P5, contribution by 3 focus group members

Line Number	Transcription	Code
150 151 152 153 154 155 156 157 158	Interfacing is connecting two or more different entities. In our case, it is connecting one or more systems with SAP. Now extending our previous example, you are replacing some legacy applications, but there are some applications that you don't want to replace yet. You need to somehow pass data back and forth between SAP and these remaining systems at the value partners' sites. Make sure everyone involved knows what pieces of data must be going one way or the other way or both ways. That's critical, because you will still need to do some data transformations/translations, etc. to make the data understandable to the receiving system. This will continue as long as you want to keep the systems running alongside SAP.	5-1 5-2 5-3 5-4
159 160 161 162 163 164 165 166	In heterogeneous IT landscapes, you've got to specify the data being passed back and forth between what is in these landscapes and the big shared SAP, otherwise you have no way to get a handle on failure points between technologies. If your client strives to become more real-time, and more collaborative, then you've got to move integration closer to the applications of both your client and their suppliers. What I do is to make a list of those apps that will go on the SAP Exchange Infrastructure, the vehicle that's bringing you the ability to connect all relevant applications, regardless of whether it is an application from SAP or from a 3rd party.	5-2 5-4 5-3
167 168 169 170 171 172 173 174	I think a good practice in this case is to set up a life cycle for your interfaces. We do it this way because the interfaces cost us a significant effort in development, design and implementation. What I do is this: first I get a Data Designer to work with the business owners to determine the data mapping and complete the functional design. 2.If the interface is automated, the Technical Designer converts it into a technical specification for the interface program. 3.The developer used the design to build and test the interface program. And I have five rounds of tests done until they migrate the interface to the production environment.	5-3 5-4 5-3 5-2

match well with the architects' mappings. However, we observed four pairs of practices and their associated levels which did not meet the 75% cut-off level. These are the practices labeled P2, P6, P10, and P12, and they all refer to the role of modeling in inter-organizational ERP RE. They were subjected to a second review by the architects. The outcomes of this review are summarized in the section that follows Table 4.

Focus Group Members' Review of the Practices below the 75% Cut-Off Level

Practices P2 and P6: The focus group accepted practices P2 and P6 for all complexity levels. In the original proposal (Daneva & Wieringa, 2006) (Table 1), these two practices had been associated with Coordination Complexity Levels 2 and 3 only. We had not associated these practices with Level 4, because the literature suggests that, in a competitive collaboration (that is, an inter-firm partnership made up of competing companies in the same sector), the more the competitors share, the more this weakens one partner vis-à-vis the others. However, the focus group members provided observations about those cases in which the benefits of sharing can far outweigh the disadvantages. Our focus group members' arguments for associating these practices with Level 4 (and not only with Levels 2 and 3, as was the case in our original proposal) are as follows:

- Practices P2 and P6 create opportunities for each company in an extended enterprise to learn from their partners. According to the ERP architects, learning from each other is at the core of successful competitive collaborations.

Table 3. Inter-organizational ERP RE practices observed by 18 ERP architects

RE Practice	Number of architects observing it
P1. Define how work is divided among partner companies	18
P2. For each network partner, document data, processes, and communication channels to be shared and with whom	17
P3. Document the values and goals to be shared and with whom	11
P4. Collect enough knowledge about the ERP-supported internal processes before aiming for cooperative ERP scenarios	8
P5. Document what separately kept application data of partner companies will be shared via interfaces to a common ERP system	18
P6. Align what is shared to what is kept separate	18
P7. Discover and document the market-making mechanisms and common learning models for partners to share	0
P8. Understand how ERP-supported coordination mechanisms will be used	18
P9. Assess the compatibility of partner companies' values and beliefs	9
P10. Make a business coordination model	12
P11. Map the business coordination model to a set of ERP-supported coordination mechanisms	6
P12. Use the reference architecture for the package provided by the ERP vendor	18
P13. Validate the coordination models and their execution	10

- A company is willing to use competitive collaboration outside the formal agreements, and diffuse new knowledge through competitive tactics (not only through shared goals, as is the case with practice P3).
- Being explicit on what is shared is a way to control the unintended release of sensitive information between competing partner companies.
- In competitive collaborations, understanding what is shared helps competitors get close enough to predict the behavior of their rivals when the partnership unravels or has run its course.

These points led us to conclude that we need a deeper analysis of practices P2 and P6, and also an analysis at a finer level of granularity. We think that these two practices are interdependent, and may also depend on the choice of other practices. So, we decided to analyze the possible scenarios in which practices can be combined, so that we can clearly obtain incremental complexity stratification. This constitutes a line of enquiry for future research.

Practice P10: The focus group was divided according to three standpoints on positioning practice P10. Nine architects thought that documenting inter-organizational coordination processes should be conducted by Level 4 ERP adopters, because this is a very expensive effort and its pay-offs are much less tangible for Level 2 or 3 organizations. These architects witnessed Level 2 and 3 organizations modeling inter-organizational processes only when the costs for this are split among the partner companies in the network. When there is no consensus on cost-sharing, each partner takes the responsibility of modeling their own part of the process using their own preferred modeling techniques and tools. Special attention is paid, then, to the part-

Table 4. Inter-organizational ERP RE associated with complexity levels by 18 ERP architects

RE Practice	Complexity level in Table 1	Architects' rankings for a Level 2 match	Architects' rankings for a Level 3 match	Architects' rankings for a Level 4 match	Architects' rankings for Levels 2 and 3 match	Architects' rankings for Levels 3 and 4 match	Architects' rankings for Levels 2,3, and 4 match	Correct (%)
P1. Define how work is divided among partner companies	2,3,4	-	-	-	-	-	18	100.00
P2. For each network partner, document data, processes, and communication channels to be shared and with whom	2,3	1	1	1	-	-	15	5.55
P3. Document the values and goals to be shared and with whom	4	-	-	15	-	3	-	83.33
P4. Collect enough knowledge about the ERP-supported internal processes before aiming for cooperative ERP scenarios	4	-	-	14	-	4	-	77.77
P5. Document what separately kept application data of partner companies will be shared via interfaces to a common ERP system	3	2	14		2			77.77
P6. Align what is shared to what is kept separate	4	-	1	1	-	1	15	5.55
P8. Understand how ERP-supported coordination mechanisms will be used	3	-	15	-	3	-	-	83.33
P9. Assess the compatibility of partner companies' values and beliefs	2,3,4	-	-	-	-	3	15	83.33
P10. Make a business coordination model	2,3,4	-	-	-	5	-	9	50.00
P11. Map the business coordination model to a set of ERP-supported coordination mechanisms	2,3,4	-	-	-	-	1	17	94.44
P12. Use the reference architecture for the package provided by the ERP vendor	2,3,4	-	-	6	-	10	2	11.11
P13. Validate the coordination models and their execution	2,3,4	1	1	-	-	-	16	88.88

nering companies' process interface points. This is where process ownership changes, or where one company hands over process execution to another.

Furthermore, five experts associated practice P10 to Level 2 and Level 3, and argued that modeling prior to architecture design is critical: (1) to the remaining implementation stages; and (2) to the architects' ability to connect the inter-organizational solution built now with the one to be built in the future. The attitude of these architects converged with findings published by Roser et al. (2006) on the importance of explicit modeling of inter-organizational business processes for the solution architecture. These authors investigated an inter-organizational system development environment in which the model transformation approach was used to design a shared system, and concluded that, unless inter-organizational processes are modeled, "*model transformation results are likely to be of poor quality*." In their study, the authors maintain that different types of architectural concepts rely to a different extent on the existence of explicit models of the inter-organizational business process. We therefore hypothesize that the experiences of the five architects might well refer to the implementation of a solution architecture that might have been highly dependent on the existence of models. We were not able however, to discuss this point with the five architects during the study, as the publication of Roser et al. (2006) was identified after the focus group process was over. Nevertheless, we feel motivated to initiate a follow-up research effort in the near future to gain a deeper understanding of the point raised by these five architects.

Four architects insisted that modeling is a "*Level 1 organization's business*" (as one architect put it), and therefore should not be part of the discussion on inter-organizational coordination. Another participant added, "*You either invest in modeling tools and standards within your own organization and you know why you are doing this, or you do not invest in them at all. If you invest in them, you do this because it's of value to your organization, not because of the collaboration. You either have the stomach for models, or you do not. And if you do not, then you write text; and the most important thing is that everyone else can understand your text. That's what counts most. And not whether you have models or not.*" The four focus group members also claimed that, unless an organization has an established modeling culture, coordination process modeling would not make much sense, as it may even be perceived as sunk costs from a high level management perspective. Two architects went on to give multiple examples of inter-firm partnerships in which large companies that were pushy and domineering with respect to their partners tried to make those partners adopt complex business process modeling tools (namely the ARIS toolset and LiveModel) and instill the discipline of business process modeling in what they refer to as a "*mega-project setting*" ('mega-project' is the term they use to describe a very large project). These ERP adopters threw large budgets into hiring external consultants, who created "tons of models that became shelfware eight months after the project was over." The following are two examples of mechanisms through which this happened. In one case, the executive who championed the introduction of the (SAP) modeling standards and tools in a partner company left the organization shortly after the system went live. His departure triggered a chain of restructuring actions that ended with job changes for the business managers, who were initially active supporters of the modeling effort. Once the modeling process had lost its support, the company staff reverted to their old way of "*getting their documentation done*." In the second case, the company had a culture of agile ERP adoption. They had a few trained and dedicated modeling analysts, but they specialized in another modeling approach ("*light-weight*" and "*more flexible and creative*", relying on story-telling that is similar to business process analysis in the agile project). Also, the business managers who were experienced in using this approach perceived that the SAP modeling notation was not intuitive and too rigid in

their culture. They felt no incentive to spend time on modeling (e.g. to report on changes in the SAP models, or to validate the models on a regular basis), as the hours spent on these tasks would be considered as overtime "*on top of their other commitments*." Because modeling was not linked to their job performance objectives, business managers perceived it as "*a big company's thing*" that did not warrant their time and attention. Moreover, the two architects also shared that on some occasions they received explicit instructions from their directors to consider shared process fragments and data objects within the shared ERP system as "*a black box*", and to focus exclusively on those pieces of text documentation that "*add business value to the project stakeholders*." According to one of these architects: "*You might think you would need the models later on, but if your partners do not care about models, then creating models will be an impediment to quickly delivering the working solution*."

What all the focus group members agreed on was that modeling the current coordination requirements has key implications in terms of handling requirements for follow-up ERP projects in three categories: (1) ERP upgrades, (2) system consolidation, and (3) maintenance projects. So, we decided to leave the practice mapped to Levels 2, 3, and 4 (as it was in the original proposal (Daneva, 2010) (Table 1), but flag this practice as a subject for follow-up studies. The fact that this practice divided the focus group members into three sub-groups and received controversial reactions from multiple perspectives made us think that it is worthwhile investigating two research questions: (1) why do these variations in perspective exist; and (2) why does variation exist, even among the ERP architects who shared a common position regarding the complexity level with which this practice should be associated.

Practice P12: The fourth practice below the 75% cut-off level was P12. Sixteen architects found P12 to be the most controversial activity in ERP project implementation. Six of the sixteen architects associated it with Level 4 ERP adopters, because, in their opinion, reference models are truly beneficial in extended enterprises among competitors. Ten architects argued that reference models do not capture shared data control flows and that this is a key roadblock to using them efficiently in organizations with a complexity level higher than 2. Their key concerns were that: (1) to efficiently use the reference models, representatives of all the partner companies must spend time and budget to learn the modeling notation embedded in the ERP-package-specific tools and become skilled at using them; this alone was deemed unrealistic, because in inter-organizational ERP projects there is no single authority to make decisions on investing resources in the common skills of the partner companies' employees; (2) rolling out extended, enterprise-wide modeling standards and managing the licenses for any special reference modeling tools is perceived as a project in itself, and very few extended enterprises would put it high on their priority list; and (3) external consulting resources are expensive, because the inter-organizational project would need someone with knowledge of the reference models, of the tool that helps adapt them, and of the business of the extended enterprise itself, and such expertise is always pricey. Reflecting on practice P12 left the focus group unconvinced at the end of the discussion on where to place it. So, we decided to set this question aside to be researched in the future.

LIMITATIONS OF THE STUDY

We considered the possible threats to the validity (Krueger & Casey, 2008; Morgan, 1997) of our results. The major limitation of our focus group setup is that it is centered on a single focus group, which restricts the extent to which generalizations can be drawn from its outcomes. This limitation is offset by the opportunity to gain a deeper understanding of the association

between coordination RE practices and coordination complexity levels. As Morgan states (1997), generalizations are likely appropriate only for professionals in settings similar to that of our focus group members. In this respect, we consider the data as "incompletely collected" (Morgan, 1997), meaning that what has been collected is the experience of the architects.

Furthermore, we acknowledge that a plan for at least three focus groups, as the methodologists suggest (Krueger & Casey, 2008; Morgan, 1997), would have brought us much richer results. However, we could not complete it because of resource constraints. We consider this as our most important issue, and therefore it tops our agenda for consideration in future research. We plan to replicate the focus group in two other countries, namely the United States and The Netherlands, until we reach a saturation point, that is, the point at which we have collected the full range of ideas fed back to us and we are not receiving any new information (Krueger & Casey, 2008; Morgan, 1997). (Note that we did not consider tracking inter-rater agreements, because, according to Krueger and Casey (2008), it is not the goal of focus group members to come to a consensus.)

We also acknowledge the inherent weakness of focus group techniques, which is that they are driven by the researcher, meaning that there is always a residual threat to the accuracy of what focus group members say. However, we believe that this threat was significantly reduced in our study, because all the comments made online by the focus group members were transcribed in their entirety and every single e-mail exchange in the focus group was available for reference purposes.

Another validity concern in focus group studies is that the researcher influences the group interaction. However, a study by Morgan (1997) indicates that "in reality, there is no hard evidence that the focus group's moderator's impact on the data is any greater than the researcher's impact in participant observation or individual interviewing." We were also conscious that the focus group members can influence the data they produce, for example, by means of an imbalance in the level of participation of the focus group members. We made sure that the focus group was not dominated by a small number of very active participants, and that everyone had a chance to write. This was achieved by establishing policies on: (1) how to respond; and (2) what level of elaboration is expected in a response. For example, we established a one-message-at-a-time policy, according to which a focus group participant may write only one answer to a message in which there was no pointed question. We also established the policy that the researcher would approach individual focus group members any time she felt that participants did not provide detailed enough answers to pointed questions.

REFLECTION ON OUR EXPERIENCE

As per our plan, once the focus group process was over, we all reflected together on our focus group experiences for the purpose of distilling from them some lessons learned that could possibly be of benefit to other empirical RE and SE researchers undertaking focus group research. We approached the participants in order to collect their views on how they had felt throughout the focus group process. We also reflected on what worked well and why it worked well. In addition, we considered what did not work as we had expected, and why. In this reflection process, we constructed mind maps of our experiences and associated parts of these maps with what could be strengths or weaknesses of the focus group approach. While this reflection was more qualitative in nature, it allowed some lessons to crystallize, which we share below.

Strengths of the Focus Group Approach

Our experience revealed six important strengths of the online asynchronous focus group:

1. No pressure for spontaneous reactions and sufficient time for well-thought out responses.

In our experience, the choice of allowing the focus group members to work asynchronously ensured that the participants could take their time to think and to organize their thoughts before responding. They deemed it important to have the opportunity to digest the views of their fellow focus group members and formulate a response without any pressure. In the view of our participants, this choice brought the following benefits:

- New viewpoints arose as a result of taking enough time to think over their responses. Five architects shared their opinion that if they had responded spontaneously, these viewpoints would have remained unspoken.
- There was consistently no divergence from the topics. So, the responses to our questions were much more distilled.
- More in-depth responses were elicited. Our participants (again) attributed this to the time they had to reflect when formulating their answers. They agreed that taking sufficient time to think thorough the information prepared them to share, and to provide the examples they considered appropriate to illustrate their points.

2. Absence of hierarchy among the participants

The researcher ensured everyone's anonymity while running and reporting on the focus group. Because the participants were unaware of the identities of the others, they were prepared to challenge each other's views if they disagreed. This was how we obtained access to dissonant views (e.g. regarding practice P10). Also, the absence of visual cues that indicate dominance of opinions and positions in our face-to-face focus group seemed to enhance the participants' level of engagement. In the view of the authors, the idea of being part of a group whose solidarity on particular issues might be at stake simply did not apply.

3. Inclusiveness

We had participants across time zones, and we had to ensure equal access for all the participants in the discussion. Therefore, we allowed the focus group members the flexibility to drop in and out of conversations at their convenience, and to return to points of interest as further relevant comments were made. Once the questions at each stage had been aired, the transcribed conversations were made available for the duration of the discussion, so that everyone else could respond.

4. Revised role of the moderator

The first author of this paper, who served as the moderator, found that her role was not interventionist, and was actually less directive than she had expected, once the environment was set up and the rules and policies of the discussion had been established. Her experience was that carefully reading the participants' answers, as well as interjecting with probing and elucidating questions, replaced the steering role of the face-to-face moderator (which is discussed in the methodological literature on focus group research (Krueger & Casey, 2008; Morgan, 1997; Kontio et al., 2008; Orgad, 2005; Kivits, 2005). The focus group members said that they felt comfortable with the policies, and so they were willing to comply with them. They thought that this way of running the focus group would save them time, and also help the researcher to get the information she needed as quickly as possible.

5. No logistical costs

An indisputable advantage of the online focus group is the absence of logistical and coordination costs (which would otherwise be borne by the researcher) and the absence

of travel time for the participants. Organizing a face-to-face group meeting is potentially a burden for the researcher, in terms of booking a facility, finding a time that is convenient to everyone to hold a meeting, and handling any problems that might crop up (e.g. bad weather or traffic jams which could interfere with the timely start of the focus group). None of this is of any concern for an online asynchronous focus group.

6. Volume of information

An interesting, and unexpected, observation by the focus group participants was that they considered the volume of information. Fifteen of the participants indicated that they felt comfortable logging on between three and six times over the duration of the focus group (which was 10 business days), once they had made a commitment to join, and providing up to an hour's worth of comments each. We compared this to face-to-face groups, which last an average of 90 minutes (Krueger & Casey, 2008) and have 7-8 participants. We found that the average contribution of an online focus group member was much longer than that of a face-to-face group member (which would be 10 minutes, on average).

7. Combining the focus group with other qualitative research techniques

In our study, we identified a range of perspectives on some specific topics, e.g. those referring to practice P10, which motivated us to plan follow-up research using in-depth interviews to explore specific perspectives in more depth. This plan leverages the ability of the focus group method to be used in combination with other qualitative techniques (in-depth interviews, in our case). We consider this ability to be important for SE researchers, as they may need to design research setups that build on focus group insights and are aimed at responding to research questions that lend themselves to other qualitative research techniques.

8. Learning is an important incentive for practitioners to participate

As indicated earlier, some investment of time on the part of focus group members is required for the focus group to happen. Although our participants had the feeling that they were donating their time for a good cause, namely, helping a researcher make ERP RE knowledge explicit, and, thus, adding value to the knowledge chain, we think it is important that the researcher offer some specific incentives for the focus group members to participate. We found that the greatest incentive for our participants was the sharing itself, i.e. sharing of ideas and experiences. The focus group members felt that they would not have shared the information in their emails, if they had not been part of a process that was initiated and moderated by a neutral party (the researcher). This sharing process allowed them to express themselves in a way in which daily professional life rarely affords them. They referred to this sharing experience, as "a learning experience," "knowing what's going on at other sites," and "understanding that we do not do things as badly as we thought."

Weaknesses in Using the Focus Group Approach

Based on our experience, we can glean three important challenges from running an asynchronous online focus group, which, if not addressed, could render the focus group research process inefficient.

1. Lengthy analysis of the transcripts

If the researcher who is acting as a moderator wants to, or needs to, share the transcribed data with other researchers who were not originally involved in the research process, this needs to be handled with special care, and time should be allocated for these researchers to learn about the focus group process and become familiar with the information in the transcripts. Even for a senior researcher, if he or she was not involved at the start of the focus

group, it could turn out to be time-consuming to read and reread the data, in order to gain an adequate understanding of it and actively contribute to the data analysis process. The first researcher planned for two Master's students to complete two follow-up projects that would take the transcribed data as input and apply sophisticated coding (Morgan, 1997) techniques to them. However, this idea was abandoned, as the junior researchers, who were unfamiliar with qualitative analysis techniques, found it very difficult to read and make sense of the information in the long transcripts. To remedy the situation, an experienced senior researcher became involved, which made the research process costlier than originally planned. However, we think that planning early and estimating the need for sharing the knowledge produced through the focus group is key to having data analysis performed by multiple researchers.

2. The moderator and the participants need to have a common background

As the focus group members tell short stories about their everyday professional lives, they have a tendency to use their own idiomatic language, which is at times project-specific or ERP-specific. For example, the terms 'production environment' and 'development box' have specific, unambiguous meanings among SAP consultants. However, a researcher in RE or in SE who has never worked as an SAP consultant may not be able to make sense of these terms while reading the conversations. On the one hand, the researcher cannot follow up with each individual focus group member on the semantics of terms that, from the practitioners' perspective, have well-established meanings. Doing this would mean a number of clarification interactions, each one taking time. On the other hand, the researcher cannot proceed with a focus group in which he/she is behind in his/her understanding of the conversations going on. In this focus group, the moderator shared professional ground with the focus group members (as she had spent 9 years in ERP implementation project roles). However, we think it is important for the researcher to plan time to become familiar with the professional vocabulary of the practitioners and acquire basic skills in understanding the stories that will be part of their conversations.

3. Dependence on experts' availability in balancing the research design choices

There are no precise rules for a researcher to follow to determine the level of homogeneity among the participants of a focus group. It is "a judgment call" (Krueger & Casey, 2008) on the part of the researcher, based on his/her knowledge of the context and the types of participants. The focus group approach assumes that the researcher: (1) is aware of the need to strike a balance between homogeneity and variation among the participants; and (2) knows how to achieve this balance. The balance is important for two reasons: first, because it ensures that the discussion can yield contrasting positions that represent interesting insights for the researcher; and second, establishing balance means setting, up-front, the degree to which thoughts will be shared in the group discussion. It is our belief that researchers unfamiliar with the focus group method are dependent on the availability of a more senior researcher, who should consult with them on the soundness of the research design choices they make and the implications of those choices for the achievement of balance.

CONCLUSION

This paper presents the application an asynchronous online focus group-based approach to evaluating 13 practices for engineering the coordination requirements for inter-organizational ERP systems. We explored two questions regarding these practices: (1) whether or not what we think is a good inter-organizational ERP RE practice is observed by ERP architects in their project realities; and (2) if architects do observe a practice, then at what complexity level would they place it. It was our intention

to describe the extent of supporting evidence for the conclusions that we drew.

Regarding the first question, our findings suggest that 12 of the 13 practices were indeed experienced by our focus group members. The practice that the focus group members could not identify as one that happens in their project realities was deemed "too project-specific." It is a practice that addressed inter-organizational coordination in an intermediation business, and no practitioner in our focus group had had exposure to ERP projects in this business setting.

Regarding the second question, we found that, overall, the focus group members associated the practices with the levels of coordination complexity in a way that converged with ours. With respect to four practices, we found a variation between the practitioners' experience and reasoning and what we expected. We looked into why, according to the practitioners, these variations existed. Analyzing this helped us identify implications of our findings for future research. In particular, the results of our study motivated the following questions for the future:

1. What combinations of practices for engineering coordination requirements are characteristic to inter-firm partnerships that are competitive collaborations by nature (meaning ERP-adopting organizations of Level 4 coordination complexity)? What combinations of practices work best for this specific setting?
2. What are the underlying mechanisms in the inter-organizational ERP project context that are responsible for the variations in the roles that inter-organizational process modeling could play at the RE stage of the project? In which cases is this practice a good RE practice, and in which cases would it hamper the project?
3. In which inter-organizational contextual settings would reference models be a roadblock rather than an asset? How can stakeholders in an inter-firm partnership handle the trade-off between potential value and the costs of deploying reference models in RE for inter-organizational ERP?

We note that, while the use of counts in our study served an important purpose, our focus group was not about counting. We used the simplest counting scheme possible (Krishnan & Kellner, 2005), considering the number of times a practice was observable. This does not render our focus group a quantitative study. It remains qualitative one, and the methodology does not provide for our counts in Table 4 being considered as anything more than the relative results of the particular makeup of our focus group.

We have reflected on our experience of the asynchronous online focus group study. We have discussed the limitations of our research approach, and identified eight strengths and three challenges in using this research method in SE/RE research.

Last, but not least, in this paper we included detailed justifications for the more important research design choices we made. We did this not only because being explicit about our decisions in setting up our research process helps readers to understand the results, but also because we wanted to act on the calls (Sjøberg et al., 2007, Cheng & Atlee, 2007) of the empirical SE and RE communities for more empirical research in SE and RE. As Morgan (1997) indicates, explicit documentation on the motivation for our decisions – why we do what we do in one specific way and not in another – is a prerequisite for the growth of empirical research in a specific area (in our case, it is RE).

ACKNOWLEDGMENT

This research was financially supported by The Netherlands' Organization for Scientific Research (NWO) under the Jacquard project "QuadREAD" and the Joint Project "Evaluation and Selection of Complex Software Systems" between the Institute of Mathematics and Infor-

matics BAS and the Faculty of Management, Tel Aviv University.

REFERENCES

Abbas, N., Gravell, A., & Wills, G. (2010). Using factor analysis to generate clusters of agile practices. In *Proceedings of the IEEE AGILE Conference* (pp. 11-20). Washington, DC: IEEE Computer Society.

Ahituv, N., Neumann, S., & Zviran, M. (2002). A system development methodology for ERP systems. *Journal of Computer Information*, *42*(3), 56–67.

April, A., & Abran, A. (2008). *Software maintenance management: Evaluation and continuous improvement*. Hoboken, NJ: John Wiley & Sons.

Babiak, K. M. (2009). Criteria of effectiveness in multiple cross-sectoral inter-organizational relationships. *Evaluation and Program Planning*, *32*(1), 1–12. doi:10.1016/j.evalprogplan.2008.09.004

Basili, V. R. (1995). The experience factory and its relationship to other quality approaches. *Advances in Computers*, *41*, 65–82. doi:10.1016/S0065-2458(08)60231-4

Basili, V. R., Caldiera, G., McGarry, F. E., Rajerski, R., Page, G. T., & Waligora, S. (1992). The software engineering laboratory: An operational software experience factory. In *Proceedings of the International Conference on Software Engineering* (pp. 370-381). New York, NY: ACM Press.

Beecham, S., Hall, T., Britton, C., Cottee, M., & Rainer, A. (2005). Using an expert panel to validate a requirements process improvement model. *Journal of Systems and Software*, *3*, 251–275. doi:10.1016/j.jss.2004.06.004

Boehm, B., Rombach, H. D., & Zelkovitz, M. (2005). *Foundations of empirical software engineering: The legacy of Victor R. Basili*. Berlin, Germany: Springer-Verlag. doi:10.1007/3-540-27662-9

Brown, B. B. (1968). *Delphi process: A methodology used for the elicitation of opinions of experts*. Santa Monica, CA: RAND Corporation.

Brown, W., McCormick, H. W., & Thomas, S. W. (2000). *Antipatterns in project management*. Hoboken, NJ: John Wiley & Sons.

Champy, J. (2002). *X-engineering the corporation: The next frontier of business performance*. New York, NY: Warner Books.

Cheng, B. H. C., & Atlee, J. M. (2007). Research directions in requirements engineering. In *Proceedings of the International Conference on Software Engineering and the Workshop on the Future of Software Engineering* (pp. 285-303). Washington, DC: IEEE Computer Society.

Chilarege, R. (1999). *Software testing best practices (Tech. Rep. No. RC 21457 Log 96856 4/26/99)*. Armonk, NY: IBM Research.

Daneva, M. (2010). Engineering the coordination requirements in cross-organizational ERP projects. In Parthasarathy, S. (Ed.), *Enterprise information systems and implementing IT infrastructures: Challenges and issues* (pp. 1–19). Hershey, PA: IGI Global. doi:10.4018/978-1-61520-625-4.ch001

Daneva, M., & Wieringa, R. J. (2006a). A requirements engineering framework for inter-organizational ERP systems. *Requirement Engineering Journal*, *11*(3), 194–204. doi:10.1007/s00766-006-0034-9

Daneva, M., & Wieringa, R. J. (2006b). Engineering the coordination requirements in inter-organizational ERP projects: A package of good practices. In *Proceedings of the IEEE International Conference on Requirements Engineering* (pp. 311-314). Washington, DC: IEEE Computer Society.

Daneva, M., & Wieringa, R. J. (2010). Requirements engineering for enterprise systems: What we know and what we do not know? In Nurcan, S., Salinesi, C., Souveyet, C., & Ralyté, J. (Eds.), *Intentional perspectives on information systems engineering* (pp. 115–136). Berlin, Germany: Springer-Verlag. doi:10.1007/978-3-642-12544-7_7

El Emam, K., & Jung, H. (2001). An empirical evaluation of the ISO/IEC 15504 assessment model. *Journal of Systems and Software*, *59*(1), 23–43. doi:10.1016/S0164-1212(01)00046-2

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research*. Thousand Oaks, CA: Sage.

Field, A. (2005). *Discovering statistics using SPSS*. Thousand Oaks, CA: Sage.

Fragidis, G., & Tarabanis, K. (2006). From repositories of best practices to networks of best practices. In *Proceedings of the International Conference on Management of Innovation and Technology* (pp. 370-374). Washington, DC: IEEE Computer Society.

Fraser, F., Ambler, S. W., Bornstein, G., Dubinsky, Y., & Succi, G. (2007). Learning more about "software best practices." In *Proceedings of the 8th International Conference on Agile Processes in Software Engineering and Extreme Programming (XP)* (pp. 271-274).

Gaiser, T. (1997). Conducting online focus groups: A methodological discussion. *Social Science Computer Review*, *15*(2), 135–144. doi:10.1177/089443939701500202

Holland, C. P., Shaw, D. R., & Kawalek, P. (2005). BP's multi-enterprise asset management system. *Information and Software Technology*, *47*(15), 999–1007. doi:10.1016/j.infsof.2005.09.006

Jeffery, M., & Lelifeld, I. (2004). Best practices in IT portfolio management. *MIT Sloan Management Review*, 41-49.

Jones, C. (2000). *Software assessments, benchmarks, and best practices*. Reading, MA: Addison-Wesley.

Jones, C. (2007). *Estimating software costs: Bringing realism to estimating*. New York, NY: McGraw Hill.

Jones, C. (2009). *Software engineering best practices: Lessons from successful projects in the top companies*. New York, NY: McGraw Hill.

Kaner, C., Back, J., & Prettichord, B. (2001). *Lessons learned in software testing*. Hoboken, NJ: John Wiley & Sons.

King, N., & Horrock, C. (2010). *Interviews in qualitative research*. Thousand Oaks, CA: Sage.

Kivits, J. (2005). Online interviewing and the research relationship . In Hine, C. (Ed.), *Virtual methods: Issues in social research on the Internet* (pp. 35–49). Oxford, UK: Berg Publishers.

Kontio, J., Bragge, J., & Lehtola, L. (2008). The focus group research method as an empirical tool in software engineering. In Schull, F., Singer, J., & Sjøberg, D. I. K. (Eds.), *Guide to advanced empirical software engineering* (pp. 93–116). Berlin, Germany: Springer-Verlag. doi:10.1007/978-1-84800-044-5_4

Kontio, J., Lehtola, L., & Bragge, J. (2004) Using the focus group method in software engineering: obtaining practitioner and user experiences. In *Proceedings of the International Symposium on Empirical Software Engineering* (pp. 271-280). Washington, DC: IEEE Computer Society.

Krishnan, M. S., & Kellner, M. I. (2005). Measuring process consistency: Implications for reducing software defects. *IEEE Transactions on Software Engineering*, *25*(6), 800–815. doi:10.1109/32.824401

Krueger, R. A., & Casey, M. A. (2008). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage.

Le Gloahec, V., Fleurquin, R., & Sadou, S. (2008). Good practices as a quality-oriented modelling assistant. In *Proceedings of the International Conference on Quality Software* (pp. 345-348). Washington, DC: IEEE Computer Society.

Lehtola, L., Kauppinen, M., & Kujala, S. (2004). Requirements prioritization challenges in practice. In F. Bomarius & H. Iida (Eds.), *Proceedings of the International Conference on Product Focused Software Process Improvement* (LNCS 3009, pp. 497-508).

Mansar, S. L., & Reijers, H. A. (2005). Best practices in business process redesign: Validation of a redesign framework. *Computers in Industry*, *56*(5), 457–471. doi:10.1016/j.compind.2005.01.001

Marcotte, F., Grabot, B., & Affonso, R. (2008). Cooperation models for supply chain management. *International Journal of Logistics Systems and Management*, *5*(1-2), 123–153.

Massey, O. T. (2010). A proposed model for the analysis and interpretation of focus groups in evaluation research. *Evaluation and Program Planning*, *34*(1), 21–28. doi:10.1016/j.evalprogplan.2010.06.003

Merton, R. (2005). The focused interview and focus groups. *Public Opinion Quarterly*, *51*(4), 550–566. doi:10.1086/269057

Morgan, D. L. (1997). *Focus group as qualitative research method* (2nd ed., Vol. 16). Thousand Oaks, CA: Sage.

Nicolaou, A. I. (2008). Research issues on the use of ERP in inter-organizational relationships. *International Journal of Accounting Information Systems*, *9*(4), 216–226. doi:10.1016/j.accinf.2008.09.003

Orgad, S. (2005). From online to offline and back: Moving from online to offline relationships with research informants. In Hine, C. (Ed.), *Virtual methods: Issues in social research on the Internet* (pp. 51–65). Oxford, UK: Berg Publishers.

Prakash, N. (2010). Intentional alignment and interoperability in inter-organization information systems. In Nurcan, S., Salinesi, C., Souveyet, C., & Ralyté, J. (Eds.), *Intentional perspectives on information systems engineering* (pp. 101–113). Berlin, Germany: Springer-Verlag. doi:10.1007/978-3-642-12544-7_6

Ramasubbu, N., Kompalli, P., & Krishnan, M. S. (2005). Leveraging global resources: A process maturity model for managing distributed development. *IEEE Software*, *22*(3), 80–86. doi:10.1109/MS.2005.69

Roser, S., Bernhard Bauer, B., & Müller, J. (2006). Model- and architecture-driven development in the context of cross-enterprise business process engineering. In *Proceedings of the International Conference on Services Computing* (pp. 119-126). Washington, DC: IEEE Computer Society.

Schneider, K., von Hunnius, J.-P., & Basili, V. R. (2002). Experience in implementing a learning software organization. *IEEE Software*, *19*(3), 46–49. doi:10.1109/MS.2002.1003453

Schoemaker, M. L. (2007). *Requirements patterns and antipatterns: Best (and worst) practices for defining your requirements*. Reading, MA: Addison-Wesley.

Sgourev, S. V., & Zuckerman E. W. (2006). Improving capabilities through industry peer networks. *MIT Sloan Management Review*, 33-38.

Simsek, Z., & Veiga, J. F. (2000). The electronic survey technique: An integration and assessment. *Organizational Research Methods*, *3*(1), 93–115. doi:10.1177/109442810031004

Sjøberg, D. I. K., Dybå, T., & Jørgensen, M. (2007). The future of empirical methods in software engineering research. In *Proceedings of the International Conference on Software Engineering and the Workshop on the Future of Software Engineering* (pp. 358-378). Washington, DC: IEEE Computer Society.

So, C., & Scholl, W. (2009). Perceptive agile measurement: New instruments for quantitative studies in pursuit of the social-psychological effect of agile practices. In *Proceedings of the International Conference on Agile Processes in Software Engineering and Extreme Programming* (pp. 83-93).

Sommerville, I., & Sawyer, P. (1997). *Requirements engineering: A good practice guide*. Hoboken, NJ: John Wiley & Sons.

von Wangenheim, C. G., Hauck, J. C. R., Zoucas, A., Salviano, C. F., McCaffery, F., & Shull, F. (2010). Creating software process capability/maturity models. *IEEE Software*, *27*(4), 92–94. doi:10.1109/MS.2010.96

Maya Daneva is an Assistant Professor with the Information Systems Department, University of Twente, the Netherlands. She leads a company-university research program on requirements engineering and architecture design for large enterprise systems projects. Prior to this, Maya was a business process analyst in the Architecture Group of TELUS Corporation in Toronto, Canada's second largest telecommunication company, where she consulted on ERP requirements processes, architecture reuse, and sizing methods for SAP projects. Maya also was a researcher at the University of Saarbruecken, Germany, involved in improving process modeling methods for SAP. Maya authored more than 70 research and experience papers.

Niv Ahituv is the Academic Director of Netvision Institute of Internet Studies and the Marko and Lucie Chaoul Chair for Research in Information Evaluation at Tel Aviv University. From 1999 to 2002 he served as Vice President and Director General (CEO) of Tel Aviv University. From 1989 to 1994 he served as the Dean of Graduate School of Business Administration at Tel Aviv University. In 2005 he was awarded a Life Time Achievement Award by ILLA, The Israeli Association for Information Technology. Professor Ahituv represents the Israeli Government in UNESCO in issues related to Information Technology.