Challenges in Contemporary Requirements Practice

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Abstract

The management of requirements remains a key source of difficulty in systems development projects. Substantive changes in the practice of systems development and associated requirements engineering efforts suggest that a reconsideration of prevailing requirements challenges is warranted. In this essay, we report on a field study of practicing design professionals in which we assess the key challenges they experience in developing a stable set of system requirements. Building upon the findings from our study, we propose a framework for understanding contemporary requirements challenges and the ways in which they are fundamentally interrelated.

1. Introduction

Requirements processes have remained among the most profound sources of challenge in the design and development of information systems. Since the Standish Group first published its survey of information systems success and (more notably) failure [23], researchers have been quick to note that the three leading sources of development project distress are directly related to the creation and management of a project’s design requirements [1, 29, 55, 14, 34]. In addition, the problems engendered by insufficient attention to requirements issues have formed a central facet of the broader literature on requirements engineering (RE) since its very inception. In one of the earliest works to raise requirements questions, Ross and Schuman [49] stated that inadequate attention to the needs and envisioned functions of a system leads to “skyrocketing costs, missed schedules, waste and duplication, disgruntled users, and an endless series of patches and repairs euphemistically call ‘system maintenance’” (p. 6). A similar point was made by Bell & Thayer [3], who noted that problems originating in the requirements process often go undetected and later get attributed to bad design or technological limitations. The economic ramifications of requirements were recognized early on by Boehm [8] when he observed that the correction of requirements errors cost a fraction of the impact when errors go undetected until testing and implementation. Yet, despite decades of research on the subject, the “requirements mess” continues to plague information technology professionals as they struggle to design artifacts in accordance with the needs and desires of system stakeholders [37].

Complicating this pursuit is the fact that the way in which requirements are discovered, articulated, validated, and managed continues to change, and the requirements research community has struggled to keep pace with developments in requirements practice [6, 30, 31, 51]. With the rise of development outsourcing, a shift in emphasis toward commercial off-the-shelf (COTS) applications, and the widespread use of consultants and third-party systems integrators, the requirements processes for contemporary IS design initiatives are increasingly distributed across a wide range of individuals, teams, and organizations. The observation of distributed requirements phenomena presents a stark contrast to the traditional focus on requirements efforts as orchestrated by a single systems analyst with respect to the design of a standalone artifact [30].

Given the changing face of systems development processes in general, and requirements engineering (RE) in particular, it is worthwhile to assess the current practice of RE and consider what the prevalent challenges are to the management of requirements in the prevailing development environment. Accordingly, the present research is undertaken to determine what requirements challenges are most salient for contemporary IS professionals. Specifically, the research questions motivating this research include the following:

- What are the most common challenges that development professionals encounter in the elicitation, specification, and management of IS requirements?
- How are the various types of requirements challenges related to one another?

To address these questions, we conducted a field study of practicing information systems designers and
managers to determine the challenges that they perceive in the day-to-day management of requirements in their systems development efforts. The findings from this study are used to support initial theorizing about contemporary requirements challenges and the interrelationships that they reveal.

2. Research Design

In an effort to explore prevalent challenges in the current state of requirements practice across a variety of organizational contexts, we conducted a series of semi-structured interviews with IT and design practitioners from the United States and Europe. The data collection efforts were structured around an interview protocol jointly developed by the researchers. The core protocol remained constant throughout the data collection process; however, in line with the grounded theory concept of constant comparison, some questions were added to the protocol based on insights from the initial interviews [21]. In addition, interview participants were encouraged to express their thoughts on any topics which they felt were relevant to requirements processes and contemporary design environments.

To foster external validity and to address threats to the internal validity of the study, we sought participation from individuals and firms engaged in a wide variety of design environments. The research team sought participation from senior technology leaders within a range of Fortune 500 organizations. A total of 30 interviews were conducted with 39 individuals participating. The interviews included firms from a wide range of industries, including software and IT, automotive manufacturing, industrial design, aerospace, telecommunications, professional services, and healthcare sectors. Importantly, despite this range of industry domains, all of the professionals interviewed are engaged in the design of software-intensive systems. The systems development efforts involved from tens to hundreds of man-years. System costs ranged from several million to hundreds of millions of dollars.

All interviews were transcribed to support formal analysis of the data. Interview transcripts were coded using Atlas.ti. The interview protocol served as the preliminary coding structure for the data. However, in line with a grounded theory approach, additional codes were created as specific themes began to surface in the coding process [21]. The code structure was iteratively revised until the researchers determined that all relevant themes or issues were reflected [19]. Several of the interview transcripts were coded repeatedly as the final coding structure emerged. The aim of this analysis was to identify distinct challenges in current requirements processes as well as to observe recurring issues in the day-to-day practice of requirements work.

Through this data collection and analysis, we identify a series of salient challenges in contemporary requirements process. Because this is a grounded theory effort, we did not approach the data with a preconceived theoretical perspective. Rather, we draw upon our findings to develop a theoretical framework for understanding requirements challenges and the interrelationships that exist between them. In the next section, we discuss the core themes that surfaced in our analysis before moving on to the theory development that they support.

3. Findings

The IS professionals who participated in the field study discussed a wide range of challenges to their requirements processes. Through a thematic analysis of the interview data, we identified the key impediments that recur across multiple organizations and development environments. While idiosyncratic issues were raised in the interview process, in our discussion of findings we focus on those challenges or themes that were salient across multiple organizations and respondents.¹ These primary challenges can be grouped into three broad categories: 1) individual cognitive challenges, 2) interpersonal challenges, and 3) complexity challenges.²

3.1. Individual Cognitive Challenges

Several of the critical challenges noted by the field study respondents focus on the inherent limitations of individual thought processes. These challenges impact the ability of systems stakeholders to express their needs explicitly, to overcome the conceptual boundaries of their existing environments, and to envision a future marked by novel processes and IT-based resources.

3.1.1. Articulation Challenges. One of the most consistent impediments to effective requirements elicitation is the inability for individual users or relevant stakeholders to articulate their needs concisely and concretely. When asked about the goals or

¹ For the purposes of establishing a threshold for “recurring” themes, we limit our core discussion of findings to those that were identified by representatives of three or more organizations.

² This classification structure was determined based on our analyses of the data, rather than on an a priori schema.
functionality that they would like to see reflected in a new system, individuals are frequently not capable of stating explicitly their desired outcomes. The perception that articulation issues are a reflection of differing perspectives between users and designers, or between different classes of users, is quite prevalent. The following statements are exemplary of this perception:

“How do you translate the requirements of a business leader who’s not necessarily technically orientated? Even those who are, are not necessarily business process modeling experts, right. And they’re certainly not IT experts.”

“But it’s a different mindset, right? People who sell great don’t want to sit around wondering how you improve a process ... make it more efficient. People who love to make a process more efficient don’t want to be bothered with the hassle of trying to get someone to buy your product.”

Some respondents feel that the impediments reflect the inability of business professionals to be reflective about their activities and needs. In essence, this amounts to concern that the articulation of requirements is not seen as priority for the users. For example, one respondent observed:

“Well usually the problem is that customers don’t spend much time really thinking about requirements, they simply expect you to do the formalization and the specification of the requirements ... Then you usually get very low quality requirements and you have to do a lot of work afterwards to understand what they really want from you ... ”

In contrast, several respondents felt that the inability to articulate requirements stemmed not from a deficiency in the reflectiveness of the users, but in the conditions that they face. Specifically, these designers perceived that difficulty in clarifying requirements is a reflection of the rising complexity of the systems landscape. One respondent’s reflections summarize the point effectively:

“Business is just changing so fast today that the definition of a requirement today, it seems to me, is more difficult than what it was ten years ago ... It’s just so much more complex today. And so it’s difficult for that user to define what they want.”

Thus, the challenges to articulation that have been observed for many years may be augmented by the rising complexity observed in contemporary systems. Encountering an increasingly heterogeneous set of IT artifacts that interact in undetermined ways, users struggle to understand their needs on a “go-forward” basis. This challenge of expressing ones requirements concretely is closely linked to the inability to discern alternate future states.

3.1.2. Vision Generation and Paradigm Constraints.

A second class of requirements challenges based on the limits of individual cognition is the difficulty that users experience in envisioning a future that differs substantially from their present environment. We refer to this dynamic as the persistence of paradigm constraints. When asked about requirements for a new system, users frequently focus on features or functionality that remain fundamentally consistent with their existing processes and systems capability – i.e., their prevailing paradigm of business practice. Users appear to be anchoring their perceptions of what can be achieved to the platforms with which they are already familiar. The following statements illustrate this concern:

“But the problem is that people think within the box, the end user thinks within the box because they think their own paradigm. They’ve got to do breakthrough thinking in order to change things in a fashion that is just dramatic.”

“When you’re talking about future capabilities, do you have people on the business side that can think out into the future vs. getting stuck in, ‘Well, this is how we operate today.’”

While reflecting on the challenges that such paradigm constraints pose, some of the respondents noted strategies that they believed could help eliminate this impediment. For several respondents, the introduction of third-party consultants serves to break down the preconceived notions or expectations of the business users. For example:

“And that’s actually some of the benefits of bringing an organization like ours to a client is because we bring those new, you know, new ideas, new ways of doing things and showing them, you know, what’s possible with respect to the different requirements and capabilities.”

“If I showed you this technology solution that they’re using in some other industry - look at how they do this over in the retail world. How can you apply that to the financial services world? Wow, if I could do this, this, and this, you know what we could do?”
3.2. Interpersonal Challenges

A second class of the requirements challenges discussed by respondents in our field study center on the interpersonal processes through which requirements are identified, specified, and managed. In modern systems development environments, nearly all requirements determination efforts entail a social element, with analysts or other design teams members interacting with proposed users, executive project sponsors, and other stakeholders. In addition, there is significant interpersonal interaction between different sub-groups of the design team itself. Not surprisingly, a range of interpersonal issues were identified as impediments to effective requirements determination.

3.2.1. Business-IT Relationship Issues. The problematic relationship between business unit and IT personnel has achieved the status of a commonplace. It has repeatedly been observed that business and IT professionals “speak different languages” and apply differential yardsticks for desired outcomes. As a result, coordination between users and developers of an IT artifact frequently breaks down, resulting in the impediments to adoption and long term use of such resources. This challenge is perhaps nowhere more relevant than in the requirements phase of development project, when users and IT professionals are communicating most intensely.

The results of our field study suggest that IT-business relationship issues are substantial. For several respondents, the core challenge is bridging the knowledge gap between the two sides with respect to technical and business process understanding. The following statement summarizes this perspective:

“So how do you bridge that gap [with] a business leader who says, ‘You know I really want to improve customer service for my laboratory customers, and I know the way to do that is to open up more critical product information in our internal product catalogs.’ And that sounds pretty reasonable, right?”

For others, the fundamental issue is one of competition between business and IT professionals over questions of responsibility and accountability. These respondents contend that there is a degree of animosity between the lines of business and those responsible for systems development. For example:

“The last few years a lot of our people have really gotten hung up on wanting explicit process for everything ... And we went through a phase where on the business and IT sides, we were trying to call each other a little too much on not having something 100% complete”.

“They are always [telling] me, ‘I gave you the requirements, just get off my back,’ you know. Sort of this tension that IT was pedantic was sort of the interpretation. So that’s always a challenge I think, always a tension.”

The clear message from all these responses is that there remains significant room for improvement in the relationship between line of business and IT units. One of the most salient opportunities for advancing this agenda is the enhancement of communication skills, particularly among members of IT design teams.

3.2.2. Communication Skills. As a socially-intensive design process, requirements engineering is built on effective communication between a wide variety of parties – not simply generalized users and developers, but different functions on the design team, distinct stakeholder groups within the user community, and a range of external partners (e.g., vendors, consultants). Accordingly, the communication skills of those driving a requirements effort are crucial to the management of the vision for a new system. Several of those interviewed called attention to concerns with the communication skills of IT representatives, particularly around the ability to query users and validate their understandings:

“Technologists are not good writers, generally speaking ... and as a result, it’s difficult for us to capture thoughts and put it into a written word. That, in and of itself, not even being able to write in complete sentences, is something difficult. And then being able to present that to end users ...”

“One [issue] is having really skilled and talented analysts that know how to query people, get information that they need and work effectively. So that’s clearly one challenge.

While most respondents placed the emphasis on the skills of the IT personnel, others felt there was a role to be played by business professionals. For example:

“Well, it seems like always the trick is, okay, if that’s what the objective is, the high level requirement, how do you get then that decomposed into something that is more specific and actionable by an IT team? And some clients are actually really great at it, and others are not.”

Regardless of where the onus for effective communication is placed, breakdowns in a shared understanding between users and developers can affect the subsequent development process. Thus, the
expectations of the users and the intentions of the developers become misaligned.

3.2.3. Managing Expectations. The third of the interpersonal impediments to effective requirements efforts is the challenge that design professionals see in managing the expectations of the system users. In systems development efforts, user satisfaction and adoption of a designed artifact is largely a function of the degree to which the solution adheres to established expectations [39]. Thus, the management of expectations among stakeholders is a critical consideration in a requirements process. Several respondents perceived that the management of expectations has become increasingly difficult with the rising complexity of systems landscapes. The following comments illustrate this perception:

“It seems for me [the challenge is] managing expectations ... The relationship of how I work and how our client works was not stable and not so mature so we know what to expect from each other ... but at the end of the day the objective is coming up with a process that works for IT and at the same time for the client.”

Interestingly, one respondent felt that the expectations of business personnel had been raised to unsustainable levels because of past achievement.

“The bad thing is that we are victims of our own success. People want more and more integrated, complicated capabilities ... You don’t get points anymore for just doing the obvious things well.”

While the management of expectations between business professionals and IT personnel is a persistent issue, the question of expectations also leads to the potential for conflicting requirements between different stakeholder groups within the business side of the development equation.

3.2.4. Conflict Resolution and Negotiation. The final interpersonal-based requirements challenge discussed by our respondents centers on the management of conflict between the requirements of different stakeholder groups. When a development effort incorporates the perspectives of a wide variety of stakeholders, the potential for inconsistencies or discrepancies between the expectations of distinct groups becomes significant. The following statement is reflective of these concerns:

“We have an owner for automation software in our electronic channel marketing area, and they’re very concerned with what’s presented to the customer and meeting the competition’s equivalent piece of software. And then we’ve got something in an entirely different area that’s going to make a feature change to some obscure feature, and it’s in conflict with something that’s already existing in this piece of software. And we truly have business side challenges to get them on board.”

In the analysis of interpersonally-based challenges to requirements practices, we distinguished challenges based on primary points of emphasis in the comments of the respondents. It is important to acknowledge the interrelatedness of these distinct challenges. For example, it can certainly be argued that challenges in requirements conflict and negotiation are closely linked to the communication skills of both business and IT professionals. Yet, we assert that the distinction is beneficial, because it reflects the conceptual ordering reflected in our respondents’ insights and it highlights different facets of the complex social dynamic played out in the requirements phase of design. This emphasis on complexity is extended in the final broad category.

3.3. Complexity-based Challenges

Increased complexity of the systems development environment is a consistent perception among the design professionals interviewed. In particular, our respondents suggest that, as the complexity of software development activities themselves has declined, the broader interdependence of system components and stakeholders has created a significant expansion of complexity in the systems landscape. Key drivers of this complexity include the proliferation of system components, widespread emphasis on COTS over bespoke development, geographic distribution of users and developers alike, and the increased use of inter-organizational systems. This increased complexity has significant implications for the conduct of requirements efforts.

3.3.1. Prioritization. The challenge of prioritizing a wide variety of requirements is closely linked to the issues of requirements conflict and negotiation discussed in the preceding section. When design personnel are confronted with a range of requirements from a diversity of sources (i.e., both social and artificial), they are frequently at a loss to discern which elements are truly “required” for the envisioned system. Designers struggle to develop useful heuristics for reducing requirements to a set that they see as manageable within a development effort.

Our findings suggest a relative absence of rigorous techniques to establish requirements priorities. None of the firms in our study employed formal mechanisms for requirements prioritization. Furthermore, several
respondents expressed concern about the difficulty of determining requirements priorities. The following statements are illustrative of this concern:

“Sixteen hundred different requirements, and they’re pretty big requirements, you set the edict that the maximum number of requirements that can be accommodated is a thousand. And you force the business to knock out six hundred out of sixteen hundred. You have to force that kind of painful decision making where people are just in pain knocking off requirements.”

“The other thing is just being able to prioritize the requirements because you may have a thousand requirements documented but you only have money and time to do six hundred. So how do you get from a thousand down to six hundred? … Often times it’s difficult to work through the prioritization. [It is] very hard to do.”

Importantly, an increase in the number of requirements sources for a given development effort has made it difficult to arrive a concise hierarchy of criticality.

3.3.2. Diversity of Inputs. Contemporary system development projects are marked by a tremendous heterogeneity of sources for relevant requirements. Indeed, this diversity of requirements sources and “voices” that must be integrated in the development of a given system is one of primary drivers underlying perceptions of increased complexity. The diversity of sources includes traditional stakeholder categories such as executives and representatives of functional units, but it may also incorporate third-party entities such as consultants, systems integrators, and COTS vendors. In addition, IT professionals within a firm act as sources of requirements, particularly when an enterprise architecture has been created to bound development efforts. Finally, existing information systems (i.e., both legacy systems and vendor platforms) act as a critical source of requirements for a new development effort.

In the perception of design practitioners, they have little guidance in managing the heterogeneity of requirements sources. The frustration that results among practitioners is clearly illustrated in the reflections of our respondents. For example:

“There are so many business stakeholders from different business areas that are involved in the delivery of an application that it gets complicated just by getting all of them on the same level and in agreement.”

“You may have someone taking a look at research in a particular technology and another one doing something else. There is no one single person is all I try to say. There is not one single person that does the research.”

Thus, with requirements coming from many social, technical, and regulatory sources, it becomes difficult for design professionals to settle upon a single, consistent set of requirements for a given project. A significant portion of the challenge become determining how the different sources interact with one another.

3.3.3. Defining Interactions. The diversity of inputs just discussed highlights the range of interactions that are relevant for consideration in a requirements analysis effort. Interactions between stakeholder groups, distinct business processes, and information systems components all must be incorporated into the determination of requirements. However, the complexity of these interactions in practice makes it difficult to define them appropriately using a small number of traditional modeling approaches. The design professionals repeatedly noted the impediments to a fully integrated systems landscape. The following comment captures the frustration experienced:

“Whenever we’re writing an application, we almost never end up with an application that doesn’t cross over into at least three other major systems in some way … Everything is intertwined and interfaces with everything.”

“One level of complexity is simply how a lot of our applications interact with each other, and when you’re identifying requirements for one application the stakeholders, and sometimes even the IT side, don’t quite understand what a change in a business requirement in this application may result in somewhere else down the chain.”

The challenge of defining interactions lies at the heart of the integrative complexity of contemporary IS environments [26]. As organizations increasingly emphasize the customization of commercial off-the-shelf (COTS) software over greenfield development, the demand for ascertaining interactions and effectively integrating all components becomes a central focus of IT design professionals. As the number of possible interactions grows so too does the challenge of testing the requirements that result.

3.3.4. Assessing Outcomes. The final complexity-based challenge discussed by our respondents centers on the difficulty of translating all requirements into a comprehensive testing plan. While the testing of system functionality is generally conducted well after a
requirements phase is completed, the impediments that this creates warrant discussion here because they are intimately linked to the determination of requirements for a platform. The specific challenge expressed by the design professionals we spoke with was the difficulty of assessing adherence to an ever-growing set of requirements. The apprehension of design leaders in this regard is effectively summarized in the following reflections:

“Certainly your ability to manage the sheer quantity of requirements and to be able to test those requirements [is a challenge] … On these large complex systems where you’re talking about hundreds of different applications, your ability to test in an integrated fashion is very, very hard and very costly.”

“You have problems with the developers that they don’t know how to…what to do, they don’t fully understand the requirements, down the road you have problems with testing because you don’t have a very well defined test.”

Taken together, the complexity-based challenges illustrate the range of impediments to an unproblematic specification of design requirements that flow from the growing complexity of the development environment. IT professionals are called upon to generate new and better solutions to organizational demands within ever-shorter timeframes, but it is increasingly difficult to understand and manage “all the moving parts” of the socio-technical systems which they design.

3.4. Contemporary Challenges and Prevailing RE Knowledge

As we stated at the outset of the article, the present research is motivated by the observation that development environments and associated RE practices have undergone significant transformation in recent years. Following from this, we assert that it is fruitful to reassess requirements challenges in light of prevailing practice. However, it is important to recognize that extant requirements research has explored the challenges encountered in requirements efforts since its emergence in the 1970s. Therefore, in considering the findings from our study, it is worthwhile to ask, “How do these findings compare with challenges discussed previously in the RE literature?” or, more informally, “How does this foot with what we already know?” In this assessment, it is clear that there are at once clear points of consistency with the existing scholarly record and themes that appear to be more novel. Key insights from the research literature are summarized in Table 1. While many of the requirements challenges highlighted by our respondents have been discussed across a variety of research streams, no attempt has been made to integrate these diverse issues in the requirements domain. In the next section, we pursue just such an integration. We propose a framework for discerning how these various requirements challenges are inter-related in the day-to-day practice of IS development.

Table 1. Requirements Challenges and Extant Research

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Insights from the RE and IS Literature</th>
<th>Selected Sources</th>
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<tbody>
<tr>
<td>Articulation</td>
<td>The inability to capture tacit knowledge creates gaps in the requirements understanding and subsequent problems in designed platforms</td>
<td>[12, 22, 24, 59]</td>
</tr>
<tr>
<td>Paradigm constraints</td>
<td>Limited discussion in RE; Technology frames as filters on users’ interpretation of requirements; “wicked problems” in design research</td>
<td>[11, 13, 16, 43]</td>
</tr>
<tr>
<td>Business-IT Relationship</td>
<td>Limited discussion in RE; Importance of user involvement; Business-IT partnerships to support shared knowledge, trust, and mutual credibility</td>
<td>[2, 27, 28, 41, 44, 48, 53]</td>
</tr>
<tr>
<td>Communication Skills</td>
<td>Persistent need for improved communication skills among IT professionals; frequent communication and validation are hallmarks of effective analysts</td>
<td>[25, 45, 50, 54, 57]</td>
</tr>
<tr>
<td>Managing Expectations</td>
<td>Expectations as a key determinant of IS success or failure; need for alignment of managerial expectations with technical feasibility</td>
<td>[5, 7, 9, 39, 40]</td>
</tr>
<tr>
<td>Conflict Resolution &amp; Negotiation</td>
<td>Viewpoints tradition - criticality of managing conflicts; resolving conflicts at the level of system goals; multiple negotiation practices proposed</td>
<td>[10, 15, 18, 46, 47, 52]</td>
</tr>
<tr>
<td>Prioritization</td>
<td>Multiple mechanisms for scaling requirements based on relative need; little formal prioritization in practicing development teams</td>
<td>[4, 32, 35, 38]</td>
</tr>
<tr>
<td>Diversity of Inputs</td>
<td>Limited discussion in RE; viewpoints argue for the pursuit of input from multiple stakeholder groups</td>
<td>[18, 20, 33, 52]</td>
</tr>
<tr>
<td>Defining Interactions</td>
<td>Variety of techniques for modeling system dependencies; intentional dependencies between agents in agent-based modeling and goal-oriented RE</td>
<td>[36, 42, 56, 58]</td>
</tr>
<tr>
<td>Assessing Outcomes</td>
<td>Limited discussion in the literatures assessed</td>
<td>N/A</td>
</tr>
</tbody>
</table>
4. Framework of Requirements Challenges

In our analysis of the findings from the field study, we have articulated three distinct classes of requirements challenges. However, as we noted with the manifestations of the interpersonal challenges earlier, it is worthwhile to observe that the categories of requirements challenges are fundamentally linked in several respects. For example, individual cognitive challenges can be understood as a key foundation for the socially-based challenges that emerge when multiple stakeholder groups interact in the design process. In the same way, the socially-based challenges reflect the interpersonal dynamics that form a critical basis of the organizational complexity that takes the fore in the complexity-based challenges. Considered in this light, these three categories of challenges in the management of design requirements represent interrelated impediments at three distinct levels of abstraction: the individual, social, and systemic. In Figure 1, we provide a graphical representation of this layering of the requirements challenges observed.

A number of important insights can be gleaned from this understanding of the interrelatedness of the challenges observed in contemporary requirements practice. First, the concept of distinct levels of abstraction helps us understand that the challenges we have outlined are nested to a significant extent. In software engineering, abstraction is widely employed to allow programmers to focus on a smaller set of concepts than would otherwise be necessary. A higher level abstraction of a certain class of phenomena reflects the characteristics of the lower level classes of which it is composed. The same relationships are relevant in the present discussion. We contend that the challenges observed at the social level persist in part because of the individual cognitive limitations explored at the individual level. An example may help to illustrate this concept. The challenges related to the absence of sufficient communication skills are augmented by the inability of individuals to articulate their needs and envision solutions outside of their prevailing paradigms. If such issues did not exist in the internal cognitive abilities of individuals, the demand for well-developed communication skills to guide the interpersonal exchange would be obviated. In the same way, the challenges observed at the systemic level are largely premised on the interpersonal impediments that they inherit from the social level. This is clearly illustrated by the fact that social structures are one of the key sources of complexity encountered in requirements processes.

Another observation that flows from the layering of challenges is that much of the extant RE research has focused on the lower levels of abstraction. Individual issues with articulation have been widely acknowledged since the earliest research on requirements in systems development [e.g., 3, 17]. Nearly all of the challenges discussed at the social level have some precedent in the research literature. Issues associated with an adversarial relationship between IT and line of business representatives have supported a robust stream of research in the IS domain on the engagement of users in IT design efforts [e.g., 2,
Similarly, researchers in both the IS and RE disciplines have explored the challenges of conflict resolution and negotiation from multiple perspectives [10, 15, 18, 46, 47, 52]. However, the challenges dealing with broader systemic complexity have received less attention from the RE and IS communities, and where they have been discussed few practical techniques for their resolution have made their way into the practitioner community. This suggests that there is significant opportunity for research on the requirements issues that have emerged with the increased complexity of the systems development environment. Such research could focus on any of a number of drivers for such complexity, including the proliferation of components, emphasis on COTS-based development, geographic distribution of stakeholders, diversity of requirements sources, and the rise of inter-organizational systems.

5. Conclusion

In this exploratory research effort, we have outlined a number of central challenges to effective requirements management in today’s information systems development efforts. Several of these challenges have been acknowledged for decades, representing established elements in requirements engineering research. Yet, despite significant discussion in the literature, it appears that we have made little progress toward practical guidance for the project teams that wrestle with these issues on a daily basis. In addition to the long-established concerns that continue to frustrate design professionals, we have identified a number of requirements challenges that have received little attention from the research community. In particular, we find that IS developers are plagued by a range of difficulties that flow from development environments that are increasingly complex in both social and technological terms.

Drawing upon the insights of practicing design professionals, we assert that the range of requirements challenges can be understood as fundamentally interrelated, with distinctions emerging based on the levels of abstraction considered. The challenges observed at the level of individual cognition underlie many of the difficulties which persist when social interaction is brought in view. These interpersonal challenges in turn contribute to the issues of complexity that predominate in contemporary development efforts. The persistence of this nested set of requirements challenges suggests that a fundamental rethinking of the requirements domain may be fruitful in leading design practice beyond the prevailing "requirements mess."

6. References


