

Trends and Needs in Requirements Engineering Research in Ibero-America: Insights from a Panel

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Abstract. Some aspects characterise Requirements Engineering (RE) research from different regions, whereas others constrain RE and RE approaches should not disregard them. Within this context, this paper aims to provide new insights into the trends and needs in RE research in Ibero-America. We have analysed the results from a panel at WER 2015 on the characteristics in Ibero-America that RE research should consider, the topics successfully researched in the region, the topics not sufficiently researched, and the topics on which future research should focus. Among the conclusions, Ibero-America seems to have specific social and cultural characteristics that impact RE, research on goal-oriented RE and RE for web-based systems can be regarded as successful, how to improve requirements quality should have been further studied, and RE education and knowledge transfer must be addressed in the future.

Keywords: Requirements Engineering, trends, needs, future research, panel.

1 Introduction

Although Requirements Engineering (RE) is a global research area and people from all around the world have contributed to its development, some characteristics distinguish RE research from different regions. For example, North American universities are arguably the main contributors to requirements traceability [5]. These characteristics are indicators of the trends in RE research in different regions. Certain aspects also constrain software development and RE in specific regions nowadays, such as outsourced software development to India [3], and others are expected to impact RE research in the near future, such as new software security regulations in Europe [2]. If these aspects are disregarded, then RE research results will very likely not fulfil the needs in these regions.

This paper aims to provide insights into the trends and needs in RE research in Ibero-America. To this end, we have analysed the results from a panel at WER 2015 targeted at discussing these aspects. The panel addressed the following questions: (1) What characteristics in Ibero-America should RE research carefully take into

account? (2) What RE topics have been successfully researched in Ibero-America? (3) What RE topics have not been sufficiently researched in Ibero-America? (4) What RE topics should be the main focus of Ibero-American RE research in the future?

Although panels have been arranged in many editions of RE-targeted conferences such as RE, REFSQ, and WER, and some of these panels have dealt with trends and needs in RE, we are not aware of any that has focused on these aspects for a specific region. Prior research has also argued for the relevance of considering regional characteristics for RE approach success [3], has shown that RE research topics have varied among regions [5], and has regularly proposed RE research agendas (e.g. [1]). However, most of this research has not focused on Ibero-America. Those publications that have studied Ibero-American aspects have only done it for a limited scope, such as papers at WER [7] or in Brazil [6], and not for all the panel questions. We aim to fill this gap by presenting the insights gained from the answers that people from several Ibero-America countries provided to the four questions formulated.

Three experts presented their opinion on these topics, over 20 people attended the panel, and several attendees actively participated in the discussions. According to the discussions at the panel, Ibero-America does seem to have specific characteristics that can affect RE, such as different, better communication skills when compared to other regions. Ibero-American RE research can be regarded as successful in some topics, but maybe just in a few cases. How to improve requirements quality and user experience have not been investigated enough in the past in Ibero-America, and future research must pay greater attention to how to finally materialise RE technology transfer, not only to industry but also to education institutions.

The rest of the paper is organised as follows. Section 2 describes the panel, Section 3 presents its results, and Section 4 summarises our conclusions.

2 Panel

We organised a panel at WER 2015 to answer the four questions presented in the introduction. Three experts accepted to participate as panellists. Jaelson Castro was the representative from academia in Latin America. He is very well known for his contributions to goal modelling. João Araújo was the representative from academia in Europe. He is very well known for his contributions to aspect-oriented RE and to model-driven RE. Juan José Miranda was the representative of the software industry. He is the President of the Peruvian Association of Software and Technologies. The moderator of the panel was Nelly Condori-Fernández.

Over 20 people attended the panel, from both industry and academia, and including well-known members of the RE community in Ibero-America such as Alejandro Oliveros, Julio Leite, Luis Olsina, and Óscar Pastor. The duration of the panel was around 70 minutes, and it was divided into six slots: one for panel introduction (five minutes), four for discussing the panel questions (around 15 minutes per question), and another to summarise and close the panel (five minutes). The first and the second authors took notes during the panel. A summary of the topics, the most discussed topics (topics discussed in more depth, argued by several participants and not only referred to by one), and initial conclusions were presented at the end of the panel.

3 Results

Table 1 summarises the panel results. For each panel question, the table lists the specific aspects discussed, including the controversial points. The aspects in bold correspond to the most discussed ones. The aspects are ordered first according to the depth with which they were discussed and second in alphabetical order. As can be observed, the attendees discussed challenges and the reasons for certain happenings.

The first question (**What characteristics in Ibero-America should RE research carefully take into account?**) is the most balanced in relation to the number of controversial and of non-controversial specific aspects, thus there might not be a clear agreement upon the existence of the characteristics. Two very different positions were presented at the beginning of the question slot: some participants indicated that there are relevant different characteristics and others strongly argued that such characteristics do not exist. As the discussion developed, the number of potentially relevant characteristics increased, which suggests that they indeed exist.

Among the differentiating characteristics, the existence of cultural differences that can affect RE and the fact that people from Ibero-America probably have better communication skills than people from other regions were the most discussed specific aspects. They might especially influence requirements elicitation and negotiation. Nonetheless, we wonder about the extent to which some characteristics are really Ibero-American. The financial situation is e.g. likely a result of the global economic crisis. It can also be analysed the extent to which the characteristics are different in Ibero-America and their actual impact on a RE approach.

Regarding the controversial aspects, some characteristics seem to be negative for RE. Lack of organization or discipline in the work probably hinder the RE process because this process must aim to be systematic. There is also a conflict between one panel participant that indicated that people in Ibero-America were innovative and another that indicated that they mostly follow trends from other regions. It remains an open question to us the extent to which the fact that several countries in South America are emerging economies, or will likely grow in the near future, affects RE.

It is very surprising to us that only three RE topics were mentioned as successfully researched in Ibero-America when discussing the second question (**What RE topics have been successfully researched in Ibero-America?**). Nonetheless, there seemed to be a general agreement upon their success at the end of the question slot. Even more interestingly, this is the question with the highest number of controversial specific aspects, with a stark difference with the number of non-controversial specific aspects. In our opinion, this is an indication of little agreement upon the extent to which RE research in Ibero-America has been successful. This question also has the highest number of specific aspects discussed in more depth.

Two very different positions were presented regarding the question: some participants indicated that success had occurred only in a few cases, and others disagreed and mentioned some examples. Prior studies suggest that goal oriented RE, model-based RE, and scenario-based RE are the most addressed approaches in WER [6, 7]. This is not surprising considering that, for instance, goal-oriented RE is one of the most researched topics in Brazil. We also believe that modelling and scenario topics have been successful research areas in Ibero-America because, in general, requirements modelling appears together with other topics such as elicitation [7].

The participants claimed that the RE community in Ibero-America is small and needs the presence of more students. A cross-cutting controversial point is the lack of knowledge and technology transfer. This is a serious problem not only in Ibero-America. An aspect that could be studied is how success should be characterised, e.g. number of publications or of citations, technology transfer, or benefits provided.

Table 1. Specific aspects discussed at the panel

1) What characteristics in Ibero-America should RE res. carefully take into account?	2) What RE topics have been successfully researched in Ibero-America?
<ol style="list-style-type: none"> 1. Better communication skills, which facilitate the understanding of users, stakeholder needs, and goals 2. Culture different to other regions 3. Financial situation and economic characteristics of the region 4. History, related to e.g. having been part of Portugal and Spain 5. People are more innovative than in other regions 6. Sustainability needs <i>Controversial points</i> 7. There are no relevant differences with other regions; all the regions are the same for RE 8. Lack of organization and of systematic processes 9. People in the region have a bad reputation as a result of their behaviour 10. Ibero-America mostly follows trends from other regions 	<ol style="list-style-type: none"> 1. Goal-oriented RE 2. RE for web-based systems 3. Aspect-Oriented RE <i>Controversial points</i> 4. RE community in Ibero-America is small and needs the presence of more students 5. Success only in a few cases 6. There is a lack of industry pull to assess success 7. Research results are not transferred to education, thus it is not successful 8. Insufficient funding hinders success 9. No past RE research in Ibero-America can really be regarded as successful 10. RE research in Ibero-A. lacks recognition 11. Success is very limited when compared to the relative relevance and interest in other social areas (e.g., sports) 12. Success is biased because RE community in Ibero-A. does not evolve (same people)
3) What RE topics have not been sufficiently researched in Ibero-America?	4) What RE topics should be the main focus of Ibero-A. RE res. in the future?
<ol style="list-style-type: none"> 1. Communication means for the RE process 2. Requirements quality 3. Requirements representation languages 4. User experience 5. Communication 6. Contextual aspects 7. Further automation of the RE process 8. Health 9. Multicultural aspects for RE 10. Multi-skill needs 11. RE and software architecture 12. Requirements assessment 13. Requirements validation 14. Sustainability 15. System scope elicitation <i>Controversial point</i> 16. There has been enough research; no important topic insufficiently researched 	<ol style="list-style-type: none"> 1. Governance 2. Knowledge transfer, both to industry and to education institutions 3. Model quality 4. RE education 5. Adaptive-systems requirements 6. Apps requirements 7. Business-IT alignment 8. Cloud requirements 9. Confidence in reqs.-based estimation 10. Domain specific languages 11. Evidence-based RE 12. Rapid requirements validation 13. RE for agile 14. RE in practice 15. Requirements and architecture 16. Resilience requirements 17. System scalability 18. User profile unification

Given the amount of RE publications that researchers in Ibero-America have produced [6, 7], someone might have expected a shorter list of topics for the third panel question (**What RE topics have not been sufficiently researched in Ibero-America?**). More surprisingly, we think that some topics have indeed been researched, e.g. automation. We wonder whether the reason for regarding these topics as insufficiently researched is that some specific problems need further investigation. Another possible explanation is that the corresponding results are not mature enough.

The communication means for the RE process is regarded as not been sufficiently researched in Ibero-America even though, as presented above, people from the region probably have better communication skills and requirements elicitation is a successful research topic. These communication means impact requirements elicitation and relate to characteristics that RE research should take into account. A possible explanation is the lack of research on requirements validation and negotiation [6, 7], which involves communication and addressing aspects related to user experience.

Requirements quality has been identified as an insufficiently investigated point, as well as requirements representation languages. The latter is surprising because of the extensive prior work on e.g. the use of models for goal-oriented, aspects-oriented, and business process-based RE [7]. It remains an open question why some topics have not been further researched. One might think of lack of background on the topics, but insufficient relevance for Ibero-America could also be a justification.

The fourth question (**What RE topics should be the main focus of Ibero-American RE research in the future?**) has the highest number of specific aspects discussed. We interpret it as evidence of the interest in deciding upon and proposing topics for future research. It is also noteworthy that no controversial point was discussed for this aspect. This suggests that future research is a clearly necessary aspect for RE in Ibero-America, in which little disagreement exists beyond on reaching a common opinion on the areas to research on.

References to most of the topics, implicitly or explicitly, can be easily found in research agendas, e.g. to quality [1]. Knowledge transfer to education institutions is an important issue to promote RE research results. University lecturers have the responsibility to integrate new RE research insights into our teaching, and to thereby extend the knowledge of the future generation of requirements engineers. Knowledge and technology transfer to industry would benefit from better advice on how to apply RE technologies more systematically [1].

The answers to this panel question refer to new software-intensive system types, e.g. apps, and to new requirements types, e.g. resilience. We regard these patterns as reasonable because such references are common. When comparing the topics mentioned in the fourth panel question with WER 2016 call for paper and CibSE scope, we have found both similarities and difference with the panel participants' opinions on what future RE research in Ibero-America should focus on.

4 Conclusions

This paper presents trends and needs in RE research in Ibero-America based on the discussions during a panel. Ibero-America seems to have specific characteristics that RE researchers should consider. We argue that future RE research should pay further

attention to the distinguishing social and cultural features of the region, identifying those that can affect the RE process and characterising the impact. Extensive research on RE has been conducted in Ibero-America and it can be regarded as successful on goal-oriented RE, RE for web-based systems, and aspect-oriented RE. On the other hand, how to improve requirements quality should have been further studied. Industry needs RE approaches that incorporate quality-targeted mechanisms in their requirements tools, e.g. metrics. Future RE research could also aim at tackling broad societal challenges such as sustainability [4], and the enhancement of RE education and knowledge transfer must be addressed. The teaching community should devise new means for RE education at both universities and companies.

This work may lead to the establishment of new partnerships in order to tackle the issues discussed, and help RE researchers focus their work on more relevant needs in Ibero-American. For industry, the results and conclusions reported are expected to help practitioners both identify aspects that must be considered in their RE processes and gain awareness of the relevant RE research results produced in Ibero-America.

Regarding the limitations of the results and conclusions presented, a reader must be aware that the insights presented strongly depend on the panel participants. They had a specific background and the representation from industry was limited. Anyway, we consider that the limitations are reasonable given the exploratory nature of a panel.

As future work, it could be valuable to replicate the panel in the future (e.g., at WER 2020) and compare the results. Systematic literature reviews could also provide a wider overview of the Ibero-American characteristics that can affect RE and of the RE research that has been conducted in the region.

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