

# A Study on the Last 11 Years of ICEIS Conference

## As Revealed by Its Words

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**Keywords:** ICEIS Survey, Tagclouds, Paper Titles, Springer Books, Conference Proceedings, Human Face.

**Abstract:** The analysis of scientific knowledge documented as journal articles, conference papers or book chapters is important for the research community to build an understanding of their field of interest. The International Conference on Enterprise Information Systems (ICEIS) is currently in its 16th edition, and it has built the state of the art in the field through scientific contributions coming from different focuses, authors and respective institutions. This work investigates the content of the Enterprise Information Systems Conference (ICEIS) by analysing data coming from two sources: the Springer Books series of selected papers from the 2003-2011 conferences, and the last three editions of the Conference Proceedings. For a visual glimpse of the themes present in the contributions, and a starter for further analysis, we used the expressive power of tagclouds on the paper titles. Results enabled to build a roadmap into the field, which may inform researchers, and practitioners who are starting work in related areas, and even experts who want to build on it.

## 1 INTRODUCTION

The analysis of institutional archives, as journal articles and other media, is important for readers, authors, publishers and advertisers to understand better and more objectively their field of interest. Moreover this kind of analysis is important to emphasize the interests, identity and culture in a certain research area over time (Soper, 2012), providing a glimpse of trends, modes of thought and the potential future for the area.

The International Conference on Enterprise Information Systems (ICEIS) is currently in its 16<sup>th</sup> edition, and it has built the state of the art in the field through scientific contributions in topics such as: Databases and Information Systems Integration; Artificial Intelligence and Decision Support Systems; Information Systems Analysis and Specification; Software Agents and Internet Computing; Human-Computer Interaction; and more recently Enterprise Architecture.

This work investigates the content of the Enterprise Information Systems Conference (ICEIS) to get a picture of the main subjects addressed in the field, and the origin of the contributions in terms of their authors and respective institutions. The research was conducted from two sources: a) the

selected papers since 2003 (5<sup>th</sup> ICEIS) to 2011 (13<sup>th</sup> ICEIS) published by Springer Books (SB), and b) the complete last three years of the Conference Proceedings (CP): 2011, 2012 and 2013.

A set of 341 selected works was published by Springer Books during this period: 38 in 2003, 38 in 2004, 29 in 2005, 31 in 2006, 29 in 2007, 26 in 2008, 81 in 2009, 41 in 2010, and 28 in 2011, as shown in Figure 1.

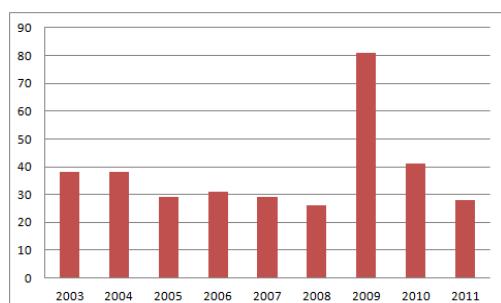


Figure 1: Number of selected works published by SB (2003-2011).

A second set of 719 works was published in the Conference Proceedings during the last three editions of the Conference: 361 in 2011, 165 in 2012, and 193 in 2013, as shown in Figure 2.

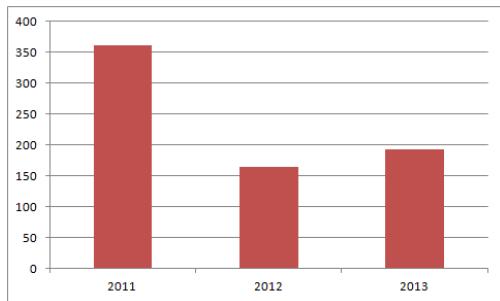


Figure 2: Number of works published in the last three CP.

For an overview of the themes present in the contributions, we used the expressive power of representations known as tagclouds (tag clouds). A tagcloud is a visual representation of a set of words, typically tags (labels), which gained notoriety when it was used in social software sites such as "del.icio.us®" or "flickr®". Each word is highlighted within the cloud according to its importance within the set of words, and gain enhancement through manipulation of visual characteristics, such as font size, color, weight, etc. (Bateman, 2008). For Rivadeneira et. al. 2007, this format is useful for quickly providing the most prominent terms and relative importance of a specific word within the analyzed set. Also, it provides a general impression of the whole words set and the "essence" of the data represented. For example, in social software sites, the tagclouds can provide an impression about interests or expertise of a person.

Discussions in this work are situated from the creation and observation of tagclouds formed with the words in the article titles. We were especially interested in knowing the main subject matters of the Conference as revealed by the words in titles of the accepted papers, observe the representativeness of the contributions in terms of the diversity characterizing authors' origin, and understand the movement of that community.

Therefore, this paper aims at providing a roadmap on work in the field, and showing the origin of major authors. This information may be helpful for researchers and practitioners who are starting work in the field, and even for experts who want to build on it. Moreover, we want also to have a look at the "human face" of ICEIS by analyzing the HCI area of the Book and of the last Proceedings.

The paper is organized as follows: Section 2 presents the method and representation used in the data collection and analysis; Section 3 presents an overview of results obtained with the two sets of

data; Section 4 presents and discusses a temporal analysis of the words in each year of selected set of conference papers; Section 5 presents and discusses study results for the last three editions of the Conference; Section 6 summarizes the discussed findings and Section 7 concludes pointing out further investigations.

## 2 THE STUDY METHOD AND REPRESENTATION

By visualizing the Springer Books selection of works, as well as the papers selected for the last editions of the Conference Proceedings, our goal was to provide a general view on the knowledge *corpus* in the field, enabling further investigation on issues of interest, and showing the origin of the main contributors.

### 2.1 The Review Process

The review process is a procedure based on Baranauskas and Posada (2013), organized into three phases that can be summarized in Figures 3, and 4.

#### *Phase 1: Collecting and Organizing Data*

In the first phase (Figure 3), we collected the Conference information from the two sources: Springer Digital Library (Springer Books) and the Proceedings of the last three years of the Conference. Once obtained the information, we conducted a process for searching similarities between the names of the authors of the different papers, to normalize their writing (eg: accentuations, abbreviations, spaces), to make correct counting. After, we proceeded to the identification of the authors with at least two publications in the Conference. Finally in this phase, we localized each of these authors' institution, at the time of publication, and the country where the institution is located; of course, this information also needed to be standardized.

#### *Phase 2: Processing and Visualizing Data*

In the second phase (Figure 4, first block), all the works published by the two sources (the Springer Books and the last 3 Conference Procedures) were considered separately. A general-specific strategy was adopted to generate visualizations for the whole set of papers: general level for SB and for CP independently, and specific level (specific subtopics) of each set SB and CP were investigated. We operationalized this strategy, using tagclouds. We created a general tagcloud considering all the

contributions of each information source (SB and CP), one tagcloud for each year of the conference, one tagcloud of the authors with more than two works in the Conference, and, finally, tagclouds for the countries and institutions, according to the number of contributing authors, limited only to the list of selected authors. This set of tagclouds, gave us an overview of the terms discussed in the works, representative authors, the institutions with the greatest contribution, as well as the countries from where these contributions come.

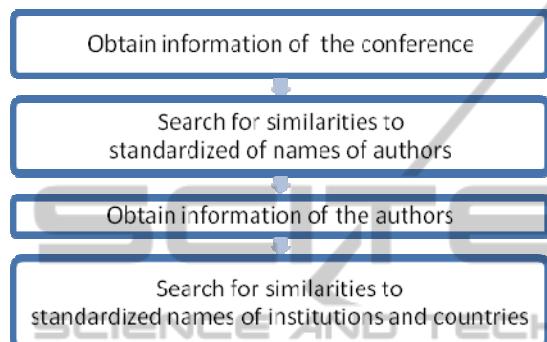


Figure 3: Phase 1: Collecting and Organizing Data.

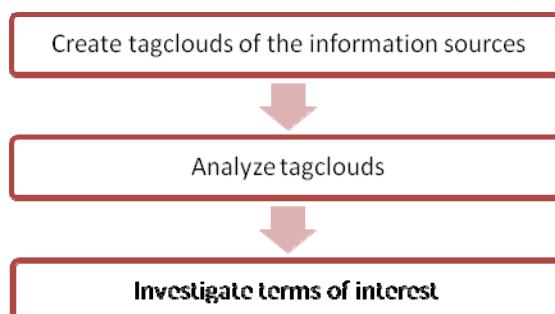


Figure 4: Phases 2 and 3: Processing, Visualizing and Analysing Data.

#### *Phase 3: Cross-analysis of Data*

Finally all the information produced in the previous steps were crossed and analyzed (Figure 4, second and third blocks). The analysis was supported by a tool developed to enable, among other things, the identification of all papers that have some term of interest in their titles. The tool indicates the amount of papers that satisfy the query and the percentage that such amount represents of the total. An example of this search can be given with the "case study" expression; the tool indicates that there are 4 (1.17%) works in which the expression appears in the SB titles 2003-2011 period, and that there are 16 (2.23%) works in which the expression appears in CP titles, within 2011-

2013 period. In addition to this information, we know the amount per year, per section in each year, and the percentage that this value represents in that level. Continuing with the example, we know that the four papers selected for the SB (2003-2011) are in the years 2003, 2005, 2009, 2010, representing the percentages of 2.63%, 3.45%, 1.23%, 2.44%, respectively. The 16 works found in the CP are distributed as follows: 9 (2.49%) in 2011, 1 (0.61%) in 2012 and 6 (3.11%) in 2013. In addition, we can say that these works are in the areas of: Databases and Information Systems, Software Agents and Internet Computing, Enterprise architecture, and Human Computer Interaction. In addition to this information, the tool indicates the authors who publish on the topic of interest, institutions, and countries. For our example, the author is: Samia Oussena of United Kingdom: University of West London, with two works about "case study".

The tool was designed and built for the analysis, under this strategy, of any conference or journal dataset. It was implemented in the web to facilitate use by research community. The tool is available in <http://www.ic.unicamp.br/~jugutier/ICEIS>.

## 2.2 Data Visualization

Depending on the context in which they are used, Rivadeneira et. al. 2007 suggest four different tasks that can be performed with tagclouds: search, navigation, impression formation or gisting, recognition or correspondence. Although tagclouds are less accurate and efficient in some specific cases than other forms of visualization, such as tables and wordlist, the tagclouds are advantageous to capture the essence of large amounts of descriptive information by presenting it succinctly (Kuo, 2007).

This scenario of success, motivated by the need of a summarized analysis of a large amount of data is one of the reasons for our choice of tagclouds as a visualization mechanism in this work. For further analysis, were also used the frequency of words in the titles and its representative percentage (Phase 3).

Considering the fact that the article titles usually represent the content of the contribution (at least this is a recommendation in most conferences and journals), our analysis is done on the tagclouds generated from words present in the titles. Nevertheless, this visualization is only a starting point in the process; the tagclouds provide key terms to be further analyzed with the tool, revealing some movements in the focuses.

### 3 OVERVIEW RESULTS

To get a first impression on the whole ICEIS content, all the editions of the Springer Book, were taken together generating a general tagcloud covering the titles of the complete set of 341 selected works (2003-2011). The same was done for the 719 works of the Conference Proceedings of the last three years (2011-2013). Figures 5 and 6 respectively illustrate the tagclouds generated with these two sets.



Figure 5: Selected papers from 5<sup>th</sup> ICEIS (2003) to 13<sup>th</sup> ICEIS (2011) in the Springer Books.

In Figure 5, we can see the most salient terms in the titles of various works published by the Springer Books, relative to the papers selected from the Conferences between 2003 and 2011.

The size of the words represents the frequency of occurrence of the words. For example, the word "Systems" was more frequent than the word "Ontology". The next step in the analysis is to use our tool to further examine the terms of our interest. Returning to the example, the word "Systems" appears in 38 (11.14%) of the work titles, while the term "Ontology" appears in 12 (3.52%).



Figure 6: Papers from 13th ICEIS (2011) to 15th ICEIS (2013) Conference Proceedings.

Figure 6 illustrates the tagcloud of the 2011, 2012 and 2013 Conference Proceedings, taking

together. In this tagcloud, we see for example, that the word "Systems" appears in almost the same proportion: 77 of the paper titles (10.71%), as well as the term "Ontology" (located between the words "Networks" and "Network" in the Figure), which also continues to appear, in 16 work titles (2.23%). "Data" is a word which maintains exactly the same proportion of frequency in both sets: 65 (9.04%) of the work titles, suggesting a core concept for the conference community. Also, some words are more frequent in the Conference Proceedings than in the Springer Books, for example "enterprise" (appearing in 19 (5.57%) of the SB titles and 73 (10.15%) of CP); "management" (appearing in 16 (4.69%) of the SB titles and 64 (8.9%) of CP); "model" (appearing in 42 (12.32%) of SB titles and 148 (20.58%) of CP titles), to name some. The opposite situation also occurs; for example the word "software" is more frequent in the SB than in CP (it appears in 25 (7.33%) of the SB titles, and 34 (4.73%) of CP titles). The same result is also visible when we consider the 13th edition of the conference (2011), which has also publication of selected papers; the word "software" gains relevance (indicated by its frequency in the titles) in the SB (appearing in 6 (21.43%) of the titles), while it appears in 12 (3.32%) of the CP titles. Figures 17 and 23 show the tagclouds for the 2011 edition of the conference represented in the SB and CP respectively.

### **3.1 The Human Face of ICEIS**

As for the human presence in the SB and CP corpora, the word “user” seems to be representative of the human side of the system, appearing in 14 (4.1%) of the SB titles and 26 (3.6%) of the CP. Other representatives of the human side appear with much less salience; for instance: “person” appears in 3 (0.88%) of SB titles and 2 (0.28%) of CP; “stakeholder” appears in 4 (1.17%) of SB and 1 (0.14%) in CP; “client” appears in 1 (0.29%) of SB and do not appear in CP; and “people” do not appear at all.

While the word “social” is more frequent in the CP (appearing in 24 (3.34%) of titles) than in the SB (appearing in 4 (1.17%) of the titles), it is one of the most salient in the HCI sections of the SB (see Figure 7).

Other general representatives of HCI, for example the word "usability", appear in 1 (0.29%) of SB titles and 6 (0.83%) of CP titles. The word "accessibility" has the same frequency as "usability" in the CP and is more frequent than "usability" in the SB (appearing in 2 (0.59%) of the titles).

Looking specifically at the Human-Computer Interaction (HCI) area of the SB and CP, we want to close this section, with the two respective tagclouds shown in Figures 7 and 8. In a first look, one can notice that certain terms lose and gain relevance on the other terms. This is the case of "Analysis" and "Design" words. The first term has more highlight than the second in the SB (Figure 7), with 4 (1.17% of SB) and 3 (0.88% of SB) respectively, while the opposite happens in the last three CP (Figure 8), with 3 (0.42%) and 6 (0.83%) for the same terms.



Figure 7: HCI in the Springer Books (5th ICEIS (2003) to 13th ICEIS (2011)).

In this quick look, we can see for example that in Figure 7, there is no evidence of the word "Cognitive" (0.00%), while the term appears relevant in Figure 8, with 4 (0.56% of the Proceedings).



Figure 8: HCI in 13th ICEIS (2011) to 15th ICEIS (2013) Conference Proceedings.

As expected, the HCI typical words come mostly from the HCI area of the SB and of the CP; for example, regarding the "interface" word, which is present in 11 (1.53%) of the SB titles and 6 (1.76%) of the CP titles, 6 out of 10 titles come from the HCI area of the SB, and 10 out of 13 titles come from the HCI area of the CP. This result reinforces the contribution of the HCI area to the general knowledge corpus of the Conference.

## 4 THE TEMPORAL MOVEMENT OF THE WORDS IN THE SPRINGER BOOKS

To get a sense of the temporal movement of focuses present in the SB series, Figures 9 to 17 show the tagclouds generated for each selection of papers from ICEIS 2003 to ICEIS 2011, respectively.



Figure 9: Tagcloud of the SB selection from 5th ICEIS (2003).

"Systems", "Engineering", "Enterprise" are the most salient words shown in Figure 9, with 6 (15.79%), 4 (10.53%), and 4 (10.53%) works respectively, which correspond to the selected papers from the 5<sup>th</sup> edition of the Conference. While Systems and Enterprise are expected results as they both are part of the Conference's name, which in its 5<sup>th</sup> edition was still being characterized as a scientific community, the relevance of Engineering seems to be the basis of that community.



Figure 10: Tagcloud of the SB selection from 6th ICEIS (2004).

"Information", "Using", "Multiple" are the relevant words revealed by the tagcloud of Figure 10, with 5(13.16%), 5(13.16%), 4(10.53%) works respectively, which corresponds to the selected titles

from the 6<sup>th</sup> edition of the Conference. While Information had not appeared with the same relevance in the previous edition, as part of the Conference's name, it reflects the expected importance in this edition, while Systems and Engineering go to the background. As far as Using and Multiple words, they seem to reveal an emphasis in diversity of phenomena and instrumentalization.



Figure 11: Tagcloud of the SB selection from 7th ICEIS (2005).

While the words “Enterprise”, “Information”, and “Systems” are finally all together in the relevance focus of the 7<sup>th</sup> edition of the Conference, with 3(10.34%) the three terms, “Using” still remains in the focus, as illustrated in the tagcloud of Figure 11. Moreover, two other new words appear in the same salience level: “Detection” and “Process” also with 3(10.34%) works, suggesting search for discovery, findings, and the several involved courses of action.



Figure 12: Tagcloud of the SB selection from 8th ICEIS (2006).

While “Systems” 6 (19.35%) and “Information” 3 (9.68%) are still prominent in the tagcloud of Figure 12, the 8<sup>th</sup> edition of the Conference seems to have pulled to the surface the Web 2.0 issues, with

the salience of the words “Semantic”, “Interoperability” and “Ontology”, with 5 (16.13%), 4 (12.90%) and 3 (9.68%) works respectively.



Figure 13: Tagcloud of the SB selection from 9th ICEIS (2007).

While maintaining some words revealed in previous editions of the Conference (e.g. Systems, Using), the tagcloud corresponding to the 9<sup>th</sup> edition shows the relevance of “Business” and “Process” in the same level with 5 (17.24%) works, while revealing also “Services”, with 2 (6.90%) (Figure 13).



Figure 14: Tagcloud of the SB selection from 10th ICEIS (2008).

Figure 14 shows the tagcloud generated for the selected papers in the 10<sup>th</sup> edition of the Conference. “Engineering” is again into the scene, as well as other words already revealed in previous editions (e.g. Systems, Semantic, and Process), but a new word emerge: “Models”, while “Web” grows in salience with 4 (15.38%) and 5 (19.23%) works respectively.



Figure 15: Tagcloud of the SB selection from 11th ICEIS (2009).

“Data” 9 (11.11%) and “Service” 12 (14.81%) emerge in the tagcloud of the selected papers of the 11<sup>th</sup> edition of the Conference (Figure 15), while other relevant words still remain notable (e.g. Systems, Model, Process, Using).



Figure 16: Tagcloud of the SB selection from 12th ICEIS (2010).

The selected papers of the 12<sup>th</sup> edition of the conference, illustrated by the tagcloud of Figure 16, reveal “Support” 5(12.20%) and the “Based” adjective with 9 (21.45%), together with words already revealed in previous editions such as “Business”, “Systems”. They may suggest assistance to the systems, and the basis of the instruments usage.



Figure 17: Tagcloud of the SB selection from 13th ICEIS (2011).

Finally, the big word revealed in the tagcloud of Figure 17, which corresponds to the 13th edition of the Conference is “Software” 6 (21.43%). Although it had appeared with less emphasis in previous editions of the Conference, (6th and 11th editions, Figures 10 and 15) with 4(10.53%) and 8 (9.88%), it appears in great distinction comparatively to the other words, in this last tagcloud.

Some words are recurrent in several editions of the conference maintaining a notable frequency, although not the most salient, for example "Approach", which may suggest the continuous rapprochement to the new subjects being introduced in the Conference. Other words remain in all the editions, reinforcing the knowledge domain of this community, as for ex. "Systems", "Information", present in all the editions of the Conference.

## 4.1 Contributors in the Springer Books

The number of different authors in the Springer Books, encompassing the 5th to the 13th ICEIS is 840, viewed collectively. If we analyze each year, the distribution is as follows: 102, 100, 74, 86, 72, 66, 224, 115, 72 authors, as shown in Figure 18.

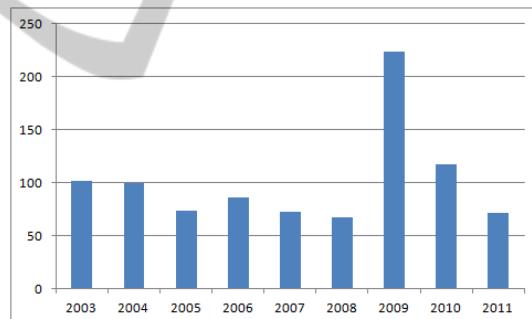


Figure 18: Number of authors in the selection of Springer Books.

Figure 19, shows the graphical presentation of the most frequent authors of the SB selected papers of the Conferences between 2003 and 2011. In order of the number of works in which the name appears as author or co-author, we have: Maria Cecília Baranauskas (5), Boris Shishkov (4), Dirk Habich (4), Mario Piattini (4), Wil M.P. van der Aalst (4), Wolfgang Lehner (4), Alejandra Cechich (3).

Of all the authors in the Springer Books (from Conferences between 2003 and 2011), we selected only those who had two or more contributions to the community of ICEIS; the number of authors that meet this requirement is 80. For each of these authors, we identified the institution in which they



Figure 19: Tagcloud of the most frequent authors of 5th to 13th ICEIS in the Springer Books series with at least 2 titles in the SBs.

are affiliated and the country where the institution is located; we have identified 13 countries with at least two contributions in the SB. The geographic distribution of these authors can be seen in Figures 20 and 21.



Figure 20: Countries of authors with at least two contributions in the SB.



Figure 21: European Countries of authors with at least two contributions in SB(E).

The number of authors, with two or more contributions, that each country contributes to the conference shows, for example: Germany (12),

Brazil (8), Italy (8), Austria (7), USA (7), Australia (6), Belgium (5), Netherlands (5), Spain (4), France (3), Cyprus (2), Portugal (2), and Romania (2).

Figure 22 shows the tagcloud created with the names of institutions with at least 2 authors contributing with at least 2 titles; we have identified 12 institutions: Dresden University of Technology (4), Queensland University of Technology (4), Vienna University of Technology (4), Johannes Kepler University Linz (3), and University of Louvain (3), Federal University of São Carlos (UFSCar) (2), Katholieke Universiteit Leuven (2), Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS) (2), Technical University of Cluj-Napoca (2), Universidad de Castilla-LaMancha (2), University of Sannio (2), and University of Twente (2).



Figure 22: Institutions with at least 2 authors contributing with at least 2 titles in the SBs.

## 5 THE LAST THREE EDITIONS OF ICEIS CONFERENCE PROCEEDINGS (2011-2013)

Looking at the last three years of the Conference through the respective proceedings, we observe that the frequent words, represented in Figures 23 to 25 are very similar with regard to the core words ("systems", "information", "enterprise"), which are also synthesized in Figure 6. Nevertheless, each year observed in isolation, presents also some particularities.



Figure 23: The 13th ICEIS (2011).

"Research" is a word with highlight, appearing in 13.85% of the tiles in 2011 (Figure 23), while the word was hardly found in the other two proceedings analyzed, and in the Springer Books selection..



Figure 24: The 14th ICEIS (2012).

“Approach” is a frequent word in the 2012 edition (Figure 24) appearing in 10.9% of the titles, and its emphasis still persists in the next year. On the other hand, “Theory” has had very low frequency in the titles of the same edition (0.6%). This may suggest the use of “approach” in place of “theories under construction”.



Figure 25: The 15th ICEIS (2013).

“Architecture” is a new highlight in the last edition (Figure 25), although it started to appear in the two previous years, growing from 2.7% to 6.0% and 11.4% in 2013, probably reflecting the recently created new subarea in the Conference.

## 5.1 Authors of the 13th to 15th ICEIS

The number of different authors in the Proceedings of the 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> ICEIS is 1730, viewed collectively. If we analyze each year, the distribution is as shown in Table 1.

Table 1: Number of authors in the proceedings.

Year	Number of different authors
2011	833
2012	479
2013	547

In Figure 26, we can see the graphical presentation of the most frequent authors of the

Conference between 2011 and 2013. The number of works in which the most frequent authors appear as author or co-author are: Zhenji Zhang (12), Maria Cecília Calani Baranauskas (11), Andreas S. Andreou (6), Runtong Zhang (6), Dan Chang (5), Li Jing (5), Manuel Castañón-Puga (5), Yongsheng Zhou (5), Gatis Vitols (4).



Figure 26: The most frequent authors of 13th to 15th ICEIS with at least 2 titles in the Proceedings.

## 5.2 Countries of the 13th to 15th ICEIS

Of all the authors of the Proceedings between 2011 and 2013, those who had two or more contributions to the community of ICEIS were 259 authors. For



Figure 27: Countries of authors with at least two contributions in 13th to 15th ICEIS.



Figure 28: European Countries of authors with at least two contributions in 13th to 15th ICEIS (E).

each of these authors, we identified the institution to which they are affiliated and the country where the institution is located; we have identified 23 countries with at least two contributions in the Proceedings. The geographic distribution of these authors can be seen in Figures 27 and 28.

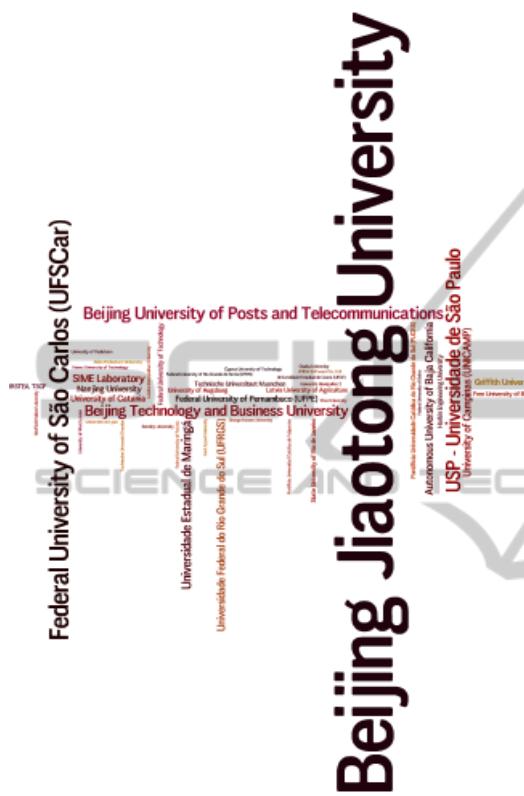


Figure 29: Institutions with at least two authors contributing with at least two titles in 13th to 15th ICEIS.

The countries of the authors with two or more papers, that contributed to the conference are: Brazil (72), China (67), France (13), Germany (12), Italy (10), Morocco (10), Australia(8), United Kingdom (8), Japan (7), Latvia(5), México(5), USA(5), Portugal (4), Algeria(3), Austria(3), Tunisia (3), Canada (2), Chile (2), Cyprus (2), India (2), Poland (2), Russia (2), and Spain (2).

Figure 29 shows a tagcloud, created with the names of institutions with at least two authors contributing with at least two titles; we have identified 44 institutions, among them: Beijing Jiaotong University (35), Federal University of São Carlos (UFSCar) (12), USP – Universidade de São Paulo (9), Beijing University of Posts and Telecommunications (8), Beijing Technology and Business University (7), Universidade Estadual de Maringá (6), Autonomous University of Baja California (5), SIME Laboratory (5), University

Federal do Rio Grande do Sul (UFRGS) (5), University of Campinas (5), Federal University of Pernambuco (UFPE) (4).

## 6 SUMMARIZED DISCUSSION

The analysis conducted in this work did not have the pretension of being complete; on the contrary, it has many open issues to be further investigated including for instance specific questions of each area of the Conference. Some highlights of analysis are synthesized as follows.

### *Regarding the reach of ICEIS*

By considering the origin of contributions, we see that the conference has had contributions of all the five world continents (America, Europe, Oceania, Asia, Africa), with 86 (33.20%), 61 (23.55%), 8 (3.09%), 78 (30.12%), and 16 (6.18%) authors respectively (considering only the Proceedings).

Observing the most salient countries, as revealed by the tagclouds representing the last three Conference Proceedings, several European countries are highlighted (e.g. France, Germany, Italy, United Kingdom, Portugal, Spain, Austria, Cyprus, Poland, Latvia), Asian countries (e.g. China, Japan, Russia, India), American countries (e.g. Brazil, USA, México, Canada, Chile), African countries (e.g. Morocco, Algeria, Tunisia), and Oceania countries (e.g. Australia).

Although the Book Series selection does not cover contributions coming from all the continents, they grasp America, Europe, and Oceania, with 15 (21.12%), 50 (70.42%), and 6 (8.45%) authors respectively.

Concerning the diversity of the contributions origin, one aspect that could be further investigated is the cultural factor or situated character that each different continent may bring to the knowledge domain covered by the Conference. *How cultural factors are being treated or represented by different groups regarding enterprise information systems? What situated knowledge do they bring to the general domain of Information Systems?*

### *Regarding the representativeness of the selected papers*

In the last three Conference Proceedings, the common salient words are: "system", "enterprise", "information", "model", "data", "business", "software", "management", "analysis", "design", "study", "process", "application", "development", "evaluation", "approach", "framework",

characterizing the nature of the Knowledge corpus being constructed. This set of words is also exposed by the tagcloud representing the Book Series, revealing a consistent selection of subject matters for the Books.

Moreover, this set of words are suggestive of a common ground knowledge among the members of this community; it also leads us to wonder about other specific terms that may be still emerging and could be subject for further investigation. *Are there other terms being expected to appear in the different areas of the Conference? Which new subjects may be emerging?*

#### *Regarding the Movement of Interests*

A general look at the movement of words in the data reveals some highlights: living aside the words in the name of the Conference (Enterprise, Information, Systems) “engineering” is in its beginning (5<sup>th</sup>, 6<sup>th</sup>, editions) reaching its peak in the 10<sup>th</sup> edition as the second most frequent word, being “Web” the most frequent word in that year. “process” is another word highlighted, as it appears among the 15 most frequent words in 7 of the 9 SB besides the last 2 editions of the CP; in the same category of words that remain salient we can observe the word “business”, appearing in 1 of the 9 SB and 2 of the 3 last editions of the Conference, and the word “data”, appearing in 6 of the 6 SB and in the last 3 CP among the 15 most frequent words. The Web 2.0 issues seem to have arisen in the 8<sup>th</sup> edition (“semantic” being the most frequent word, followed by “ontology”, “interoperability”).

While some words appear among the most frequent in the first and last editions of the SB, as for example the words “knowledge” and “learning”, both appearing in the 2003 and 2011 SBs, other words seem to have emerged lately; in the set of these words are “framework”, appearing very salient in the last two editions of the SB (2011 and 2010), as well as in the last CP, and the word “virtual”, salient in 2010 and 2009.

#### *Regarding the Human Face of ICEIS*

A quick look at the specific HCI section of the Proceedings and Books as shown by the respective tagclouds (see Section 3.1) reveals a common ground set of words shared with the Conference as a whole (e.g. “analysis”, “design”, “model”, “enterprise”) together with a focus on words relative to the specific area (e.g. “social”, “accessibility”, “users”). This may suggest an HCI approach to the enterprise information systems issues consistent with the essential subject matter of the Conference; at the same time, HCI specific issues are being introduced

into the wider focus of the Conference. It is worth noticing that the word “social” has arisen among the 15 more frequent in the 2011 SB.

As far further investigation, a similar study may be done for the other five areas of the Conference, to see their “faces” in the knowledge corpora of the Conference; e.g. *What words does the Artificial Intelligence and Decision Support Systems field (and the other areas) bring to the set? Are they representative of the field?*

## 7 CONCLUSION

The analysis of scientific knowledge documented as journal articles, conference papers or book chapters is important for the research community to build an understanding of their field of interest. The International Conference on Enterprise Information Systems, now in its 16th edition, has already built a knowledge corpus in the related fields.

Due to the numerous editions of this Conference and the wide research areas that it covers, in this paper we were interested in knowing the main subject matters of the Conference as revealed by the words in titles of the accepted papers, observe the representativeness of the contributions in terms of the diversity characterizing authors’ origin, and the movement of the community focuses along the years.

The basic analytical instrument of the exploratory study presented was the tag cloud, which produced visual representations of some of the more relevant attributes of the data. Although tag clouds are not a rigorous analytical instrument, they were useful for grasping the essence of the contributions and for inspiring further investigations, driven by the findings.

Extensions of this work, including other data representations and the classical systematic analysis based on computer-supported categorizations, are in our agenda of future work.

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