

7. Veeramani D, Tang J, Gutierrez A. (2008). A framework for assessing the value of RFID implementation by tier-one suppliers to major retailers. *Journal of Theoretical and Applied Electronic Commerce Research* 3(1), 55–70.
8. Jeong B-K, Lu Y. (2008). The impact of radio frequency identification (RFID) investment announcements on the market value of the firm. *Journal of Theoretical and Applied Electronic Commerce Research*, 3(1), 41–54.
9. Chopra S, Sodhi MS. (2007). Looking for the Bang from the RFID Buck. *Supply Chain Management Review* 11:34–41.
10. Seddon P, Greaser V, Willcocks L. (2002). Measuring organizational IS effectiveness: An overview and update of senior management perspectives. *The DATA BASE for Advances in Information Systems*, 33(2), 11–28.
11. Curtin J, Kauffman RJ, Riggings FJ. (2007). Making the “Most” out of RFID Technology: a research agenda for the study of the adoption, usage and impact of RFID. *Information Technology and Management* 8(1), 87–110.
12. Mari L, Lazzarotti V, Manzini R. (2008). Measurement in soft systems: Epistemological framework and a case study. *Measurement* 42:241–253.
13. Pigni F, Astuti S, Buonanno G. (2004). An evaluation framework for RFID Adoption. In AICA 2004 XLII Annual Congress. Benevento, Italy.
14. Bertelè U. 2006. RFID alla prova dei fatti I risultati 2006 dell’Osservatorio RFID: Politecnico di Milano
15. van de Wijngaert L, Versendaal J. (2008). Business IT Alignment and technology adoption; The case of RFID in the logistics domain. *Journal of Theoretical and Applied Electronic Commerce Research*, 3(1), 71–80.
16. Xiao Y, Yu S, Wu K, Ni Q, Janecek C, Nordstad J. (2007). Radio frequency identification: technologies, applications, and research issues. *Wireless Communications and Mobile Computing*, 7(4), 457–472.
17. Loebbecke C, Huyskens C. (2008). A Competitive Perspective on Standard-Making: Kaufhof’s RFID Project in Fashion Retailing. *Electronic Markets*, 18(1), 30–38.
18. Zhang T, Ouyang Y, He Y. (2008). Traceable air baggage handling system based on RFID tags in the airport. *Journal of Theoretical and Applied Electronic Commerce Research*, 3(1), 106–115.
19. Spivey Overby C. (2004). Revealing RFID’s Benefits in Consumer Goods, Forrester Research, Cambridge, MA.
20. Koh CE, Kim HJ, Kim EY. (2006). The impact of RFID in retail industry: issues and critical success factors. *Journal of Shopping Center Research*, 13(1), 101–117.
21. Tellkamp C. (2006). The impact of Auto-ID technology on process performance – RFID in the FMCG supply chain. *Dissertation of University of St. Gallen, Graduate school of business Administration*.
22. Munoz A, Clements MD. (2008). Disruptions in information flow: a revenue costing supply chain dilemma. *Journal of Theoretical and Applied Electronic Commerce Research*, 3(1), 30–40.
23. McFarlane D, Sheffi Y. (2003). The impact of automatic identification on supply chain operations. *The International Journal of Logistics Management*, 14(1), 1–17.
24. Michael K, McCathie L. (2005). The Pros and Cons of RFID in Supply Chain Management. *International Conference on Mobile Business*.
25. Hilger A, Ghijsen P, Semeijn J. (2007). Antecedents of logistics performance and economic performance: the case of Radio Frequency Identification (RFID). *International Journal of Business Research*, 7(6), 57–66.
26. Neely A. (2005). The evolution of performance measurement research. Developments in the last decade and a research agenda for the next. *International Journal of Operations and Production Management*, 25(12), 1264–1277.
27. Shepherd C, Gunter H. (2006). Measuring supply chain performance: current research and future directions. *International Journal of Productivity and Performance Management*, 55(3/4), 242–258.
28. Tangen S. (2005). Analysing the requirements of performance measurement systems. *Measuring Business Excellence*, 9(4), 46–54.

## Actual vs. Planned ERP System Implementation Costs in Slovak and Slovenian Companies

F. Sudzina<sup>1</sup>, A. Pucihar<sup>2</sup>, and G. Lenart<sup>3</sup>

**Abstract** Enterprise resource planning (ERP) systems are still more and more common in companies, not only in large ones but also in small and medium enterprises. Although virtually nobody really doubts their importance for running business, there is a sentiment regarding their implementation – both in terms of time and cost. We focus on the latter in this paper. The research question is to what extent do ERP system implementation costs exceed the planned costs in European context, which is characterized by fixed price policy. The questionnaire research, which focused on this issue, was conducted in Slovakia and Slovenia. The dependent variable was a percentage of actual ERP system implementation costs vis-à-vis the planned ones. The independent variables were the country, company size, information strategy, and representation of the IT department on board level. According to the collected data, companies with information strategy, and small companies as opposed to large ones, are more likely to stay on budget. Overall, 68.5% of companies stayed on budget and companies, on average, spent 106.0% of what they originally planned to.

### Introduction

The enterprise resource planning (ERP) system is an integrated set of programs that provides support for core business processes, such as production, input and output logistics, finance and accounting, sales and marketing, and human resources. An ERP system helps different parts of an organization to share data, information to reduce costs, and to improve management of business processes [1]. Wier et al.

<sup>1</sup>Copenhagen Business School, Frederiksberg, Denmark, fs.caict@cbs.dk

<sup>2</sup>University of Maribor, Faculty of Organizational Sciences, University of Maribor, Slovenia, andreja.pucihar@fov.uni-mb.si

<sup>3</sup>University of Maribor, Faculty of Organizational Sciences, University of Maribor, Slovenia, gregor.lenart@fov.uni-mb.si

[2] argue that ERP systems aim to integrate business processes and ICT into a synchronized suite of procedures, applications and metrics which goes over firms' boundaries.

ERP systems used to be a domain of large companies but there is a still increasing number of small and medium enterprises adopting adopt them as well. The reasons could be found into the saturation of the market, as most large organizations have already implemented an ERP system, increasing possibilities and need for the integration of systems between organizations and the availability of relatively inexpensive hardware [3].

Although there is a common understanding about ERP importance for running business, there is a sentiment regarding their implementation – both in terms of time and cost. Cunningham [4] investigated 7,400 IT projects and discovered that 34% of them were late or over budget. According to [5], about 90% of ERP implementations are over budget or late. According to the Standish Group report on ERP implementation projects, cited in [6], projects are on average 78% over budget and take 2.5 times longer than intended. Numerous researches noted that time and costs are key criteria for measuring ERP project implementation success [11, 12, 14]. According to research results [13] cost is a more important variable than time in judging overall ERP project success.

The research question of this paper is to what extent ERP system implementation costs exceed the planned budget. This is an important issue for the investigation on the Third Generation of ERP Systems research project ([www.3gerp.org](http://www.3gerp.org)), which aims to provide suggestions for decreasing total cost of ownership of ERP system from an end-user company view to 50%. Total cost of implementation is an important part of total cost of ownership, and therefore it is important to know what is the disparity between actual and planned total cost of implementation of ERP systems. Obviously, additional costs might be outweighed by additional benefits but total benefits of ownership are not defined as a success factor of the research project. Therefore, the paper focuses only on actual compared to total planned implementation cost.

## Data and Methodology

This exploratory paper is based on a questionnaire survey. It was conducted in Slovakia and Slovenia in May and June 2007. In 2007, Slovakia had a population 5,448 million and Slovenia of 2,009 million inhabitants. Gross domestic product per hour in 2007 EK\$ was 27.90 in Slovakia and 32.53 in Slovenia. The Networked Readiness Index (NRI) is a measure of the propensity of countries to exploit the opportunities offered by information and communications technology (ICT). The NRI tries to comprehend the impact of ICT on the competitiveness of nations. According to the NRI 2006–2007 rankings [7], Slovakia was the 41st with a score of 4.15, and Slovenia the 30th with a score of 4.41.

Questionnaire forms in respective languages accompanied by cover letters were mailed to randomly selected companies. Lists of addresses and information about the number of employees were retrieved from respective Statistical Bureaus in Slovakia and Slovenia. In each country, 600 questionnaires were sent to small, 300 to medium enterprises, and 300 to large companies. The number of questionnaires mailed to small companies was double the number of medium and large companies because small companies constitute the highest proportion of companies and based on our personal experience, they are less likely to respond. In total, there were 202 responses (112 from Slovakia, and 90 from Slovenia) out of 2400 mailings, i.e. the response rate was 8.4%.

Respondents were to answer what the actual total cost of ERP system implementation was – whether it was less than planned, as planned, or more than planned. In case that the total implementation cost did not match the planned one, they were asked how many percent less or more they actually spent on implementation. There were 111 responses, which compared actual and planned implementation costs and 105 provided enough input to calculate the actual percentage. The distribution of the answers provided is presented in Fig. 1. For the purpose of this histogram, the values were rounded to tens of percents.

Independent variables are country, company size, representation of the IT department on the board level, and information strategy. The questionnaire research was conducted in Slovakia and Slovenia. Analyzed are small, medium and large companies, where companies from 10 to 49 employees are considered to be small enterprises, companies from 50 to 249 employees are considered to be medium enterprises, and companies with 250+ employees are considered to be large enterprises. This framework is consistent with [8]. Information strategy stands for formal information strategy. Representation of the IT department on the board level means that there is a CIO or alike director for IT on the board level. Therefore, it will be described as CIO in Figs. 2–5.

In this paper, two approaches are used to investigate the actual ERP system implementation cost vis-à-vis planned costs. The first one looks into how many companies did not exceed their planned budget. There were only three Slovenian companies, which spent less than planned; they were merged with companies,

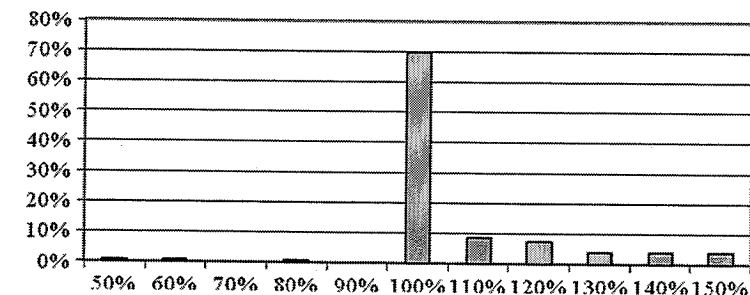


Fig. 1 Distribution of actual ERP system implementation cost vis-à-vis planned costs

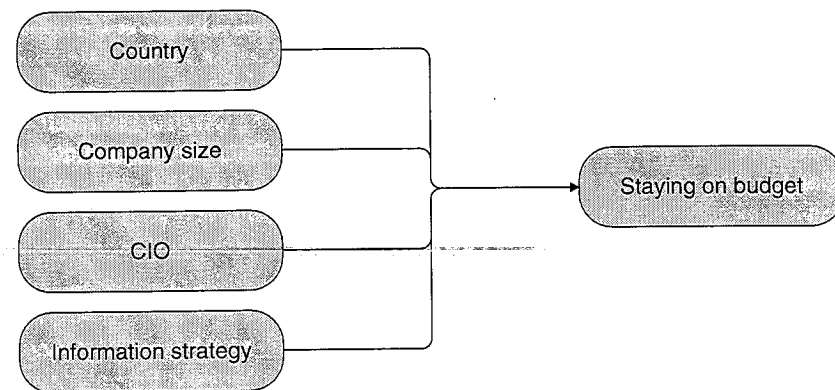


Fig. 2 Research model for the first approach

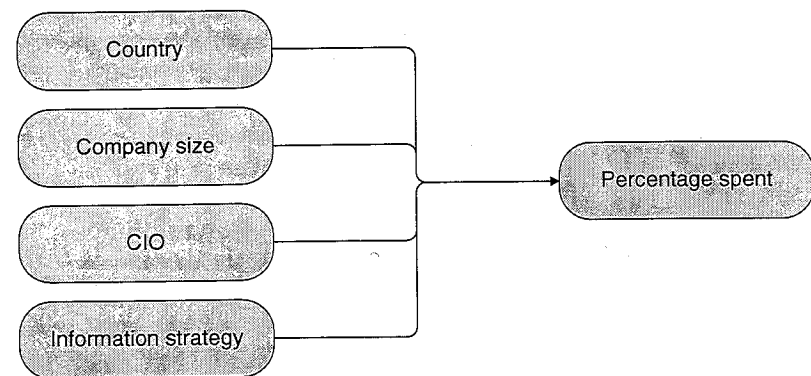


Fig. 3 Research model for the second approach

which spend exactly the amount they planned, since both can be classified as staying on budget. The research model is presented in Fig. 2.

The second approach focuses on the percentage spent compared to the planned amount. The research model is presented in Fig. 3.

Regarding the methodology, logistic regression was used for the first approach and analysis of variance (ANOVA) for the second one. Multivariate approach was used in both cases. Additionally, binomial test was used to test if there is a significant difference between the percentage of companies that stayed on budget and 50%; Tukey-Kramer multiple-comparison test was used to identify differences between individual instances of independent variables; t-test and Wilcoxon signed-rank test were used to test if there is a significant difference between the average ratio of actual ERP system implementation cost vis-à-vis planned costs and 100% (i.e. companies spending exactly according to plan). Results of the statistical tests are commented on confidence level  $\alpha=0.05$ .

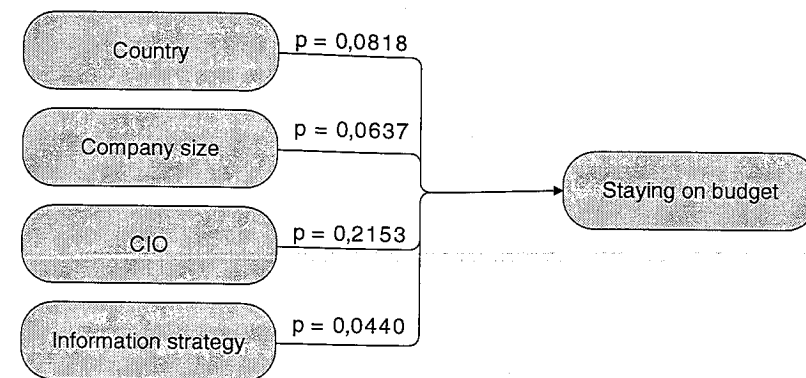


Fig. 4 Research results from the first approach

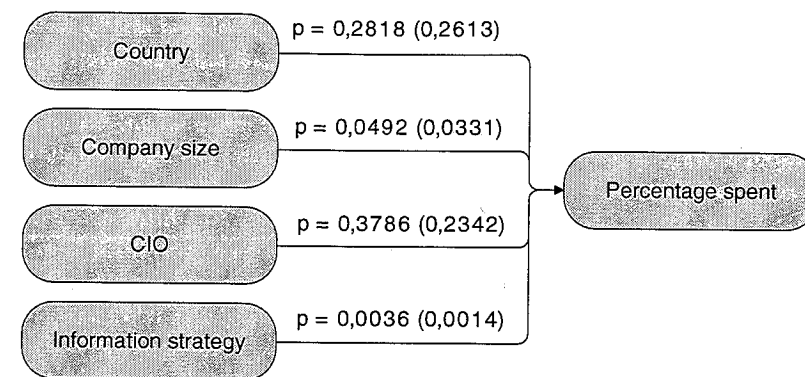


Fig. 5 Research results from the second approach

## Results

The findings from the first approach are summarized in Fig. 4. There is a significant relationship between staying on budget and having a formal information strategy. Companies with formal information strategy seem to be more likely to stay on budget (74.2%) than companies without information strategy (61.2%). Based on the p-values, it is possible to theorize that if the research sample was larger, also company size and the country might have a significant impact. Overall, 68.5% of companies stayed on budget; this percentage is significantly different from 50% (p-value=0.0001), i.e. more than one half of companies actually manages to stay on budget.

For the second approach, data were transformed into percentages and these were analyzed. Since there were six respondents, who did not provide an estimate, how much over budget they were, a dummy variable of 119.78 was introduced (it was the average percentage calculated from companies exceeding their planned budget). The findings from the second approach are summarized in Fig. 5.

**Table 1** Actual vis-à-vis planned ERP system implementation cost by size and information strategy

	Information strategy	No information strategy
Small	95.0%	107.5%
Medium	98.7%	110.4%
Large	106.2%	113.0%

In Fig. 5, p-values from the analysis of data not including and including dummy variables are provided; p-values from the analysis of data including dummy variables are in brackets. Regardless whether the dummy variable was used or not, ANOVA identified a significant relationship between the percentages of actual spending compared to planned one and information strategy, and company size. Companies with a formal information strategy were less over budget (102.8%) than companies without one (110.3%). Regarding company size, there is a significant difference between small (103.3%) and large companies (108.3%); the percentage in medium companies was 104.1%. It is consistent with Hunton et al. [9], who suggest that smaller companies possess fewer resources and are less able to attract resources compared to large companies, "thus large companies can more easily absorb and withstand ERP implementation costs.

Overall average was 106.0%. There is a significant difference between the overall average of 106.0 and 100% (no disparity between planned and actual costs). P-value is smaller than 0.0001 regardless whether t-test for difference between mean and value, or Wilcoxon signed-rank test for difference in medians is used.

Since the percentage of actual vis-à-vis planned ERP system implementation cost depends on company size and information strategy, we provide subtotals in Table 1.

These averages do not include dummy variables mentioned before; if included, averages are less than 1 percentage point higher.

Based on the results, it can be summarized that, when it comes to small and medium enterprises, companies with formal information strategy are likely to spend about 12 percentage points less than companies without information strategy. It suggests that ERP system vendors need to be sensitive to companies without information strategy, since these have either wrong expectations of costs or lack of technical skills beneficial for ERP system implementation.

### Known Limitations and Future Research

There are two known limitations of this paper, which are actually inherent for most of questionnaire surveys – response rate and reliability of data. Usually, there is an average response rate of 10% expected in questionnaire surveys. But a response rate of 80% and less (that is a case of almost all questionnaire surveys) can already lead to biased results. To overcome this problem, two thousand four hundred questionnaires were sent out to the random selected companies. The percentage of

companies being over budget (i.e. ones, which would be more likely to complain about their bad experience) is only 31.5%, i.e. less than 34% (which included also projects going over time) mentioned in [4], and surveyed companies were only 6% over budget, i.e. much less than 178% mentioned in [6]. Regarding the reliability, it is not possible to check it without being allowed to look into accounts and to talk to people involved in the implementation, who would provide insight necessary to understand the accounting data.

The future research should look into what caused additional costs. For example, customization of ERP is a crucial, lengthy, costly aspect of the implementation of ERP systems [10]. Studies have shown that many organizations exceed their budgets due to the need for more customization than they originally planned [11, 12, 16]. Besides customization, companies often run into higher than expected costs for temporary and overtime labor, re-skilling, and training during the implementation process [11, 12, 16].

Last but not least, it might be useful to investigate whether additional costs arose because of the misalignment (the gap between the standard version of the ERP system and the organization) or was it spent in order to increase benefits. Investigation of both total costs of ownership and total benefits of ownership might provide a different angle for looking at expenditures.

### Conclusions

To sum up, although not all companies manage to stay on budget when it comes to ERP system implementation, the situation is not too critical. It can be evaluated from two points of view. Firstly, about two thirds of companies still manage to stay on budget. Secondly, companies exceeded their budgets only by 6% on average. A contributing factor for Slovak and Slovenian, i.e. European, companies staying more-or-less on budget is the prevalent fixed price policy for ERP implementation projects in Europe. So, the findings might be generalized in European context but definitely not for the U.S., where effort-based pricing policy is prevalent.

A formal information strategy implies more comprehensive planning, so there should be also smaller discrepancies between the plan and the reality. Company size matters probably because large companies have more resources to invest in case it turns out that they are needed or could bring additional benefits. A slight difference between countries can be attributed to the economic situation. Probably because of the worse economic situation in Slovakia, Slovak companies do not have as much of available resources as Slovenian companies. Therefore the percentage of companies staying on budget is higher and the average excess of implementation costs is lower in Slovakia than in Slovenia. It might be a bit surprising that representation of the IT department on board level does not seem to have any impact on staying on budget. However, a chief information officer (CIO) might contribute to a very similar variance to one in companies without CIOs by deciding on-the-fly to add or to cut on certain modules of ERP system implementation.

## References

1. Aladwani, A. M. (2001) Change management strategies for successful ERP implementation, *Business Process Management Journal* 7(3): 266–275.
2. Wier, B., Hunton, J. and HassabElnaby, H. R. (2007) Enterprise resource planning systems and non-financial performance incentives: The joint impact on corporate performance, *International Journal of Accounting Information Systems* 8(3): 165–190.
3. Gable, G. and Stewart, G. (1999) SAP R/3 implementation issues for small to medium enterprises, in *Proceedings of the Fifth America's Conference on Information Systems*, 779–781, Milwaukee, WI, USA.
4. Cunningham, M. (1999). It's all about the business, *Information*, 13 (3): 83.
5. Seewald, N. (2002) Enterprise resource planning tops manufacturers' IT budgets, *Chemical week* 164(35): 34.
6. Basoglu, N., Daim, T. and Kerimoglu, O. (2007) Organizational adoption of enterprise resource planning systems: A conceptual framework, *Journal of High Technology Management Research* 18(1): 73–97.
7. World Economic Forum, The Global Information Technology Report 2006–2007, accessed on 10 June 2008, available at [http://www.greaterzuricharea.ch/content/05/downloads/2007\\_nri\\_wef.pdf](http://www.greaterzuricharea.ch/content/05/downloads/2007_nri_wef.pdf)
8. European Commission. (2008) SME Definition: Recommendation 2003/361/EC Regarding the SME Definition, accessed on 10 June 2008, available at [http://ec.europa.eu/enterprise/enterprise\\_policy/sme\\_definition/index\\_en.htm](http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm)
9. Hunton, J. E., Lippicott, B. and Reck, J. L. (2003) Enterprise resource planning systems: Comparing firm performance of adopters and non-adopters, *International Journal of Accounting Information Systems* 4(3): 165–184.
10. Gefen, D. (2002) Nurturing clients' trust to encourage engagement success during the customization of ERP systems, *Omega-International Journal of Management Science* 30(4): 287–299.
11. Markus, M. L., Axline, S., Petrie D. and Tanis, C. (2000) Learning from adopters' experiences with ERP: problems encountered and success achieved, *Journal of Information Technology* 15(4): 245–265.
12. Markus, M. L., Tanis C. and Van Fenema, P. C. (2000) Multisite ERP implementations, *Communications of the ACM* 43(4): 42–46.
13. Peslak, A. R., (2006) Enterprise resource planning success :An exploratory study of the financial executive perspective. *Industrial Management + Data Systems*, 106(9), 1288–1303.
14. Schwalbe, K. (2006), *Information Technology Project Management*, 4th ed., Thomson Course Technology, Boston, MA.
15. Swan, J., Newell S. and Robertson, M. (1999) The illusion of 'best practice' in information systems for operations management, *European Journal of Information Systems* 8(4): 284–293.
16. Sumner, M. (2000) Risk factors in enterprise-wide/ERP projects, *Journal of Information Technology* 15(4): 317–327.

## Human Computer Interaction

M.F. Costabile<sup>1</sup>

Human-computer interaction (HCI) deals with the design, evaluation, and use of interactive technologies. It is an interdisciplinary field that has gained increasing attention in the last decades due to the large impact that interactive systems have on a growing number of diverse people, including elderly, young and special needs populations. Traditional HCI topics, such as user-centred system design, usability engineering, accessibility, and information visualization are important to Management Information Systems (MIS) as they influence technology usage in business, managerial, organisational, and cultural contexts. As the user base of business interactive systems is expanding from IT experts to consumers, who access services and information via Web, new and exciting HCI research topics have emerged dealing with broader aspects of the interaction, such as designing for improving the overall user experience, favouring social connections and supporting collaboration. The aim of this track is to provide a forum for researchers and practitioners of HCI and related disciplines to discuss theories, practices, methodologies, techniques and applications about the interaction among humans, information and technology.

The final program of ITAIS 2008 includes ten papers in the HCI track, grouped in three sessions. Eight of them have been selected for inclusion in this book.

A first group of three papers concern usability and user-centred design. The first paper is by Rosanna Cassino e Maurizio Tucci, titled "Checking the consistency, completeness and usability of interactive visual applications by means of SR-Action Grammars," proposes an approach to develop visual applications, such as the visual user interface of an information system, based on SR-Action Grammars to specify visual languages. The approach gives the possibility to formally check some aspects of the usability of a system.

The second paper by Caterina Calefato, Roberto Montanari and Francesco Tesauri, titled "Mind the map – the role of shared awareness in effective user-centered design," reports a study about User-Centred design carried out in parallel by interaction designers and software developers. The study points out features that can improve the effectiveness of groups of designers with different backgrounds. The paper by Paolo Buono, Adalberto L. Simeone, titled "An experience about

<sup>1</sup>Università di Bari, Bari, Italy, [costabile@di.uniba.it](mailto:costabile@di.uniba.it)