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Mission

The mission of the IJISPM - International Journal of Information Systems and Project Management - is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

The IJISPM publishes leading scholarly and practical research articles that aim to advance the information systems management and project management fields of knowledge, featuring state-of-the-art research, theories, approaches, methodologies, techniques, and applications.

The journal serves academics, practitioners, chief information officers, project managers, consultants, and senior executives of organizations, establishing an effective communication channel between them.

Description

The IJISPM offers wide ranging and comprehensive coverage of all aspects of information systems management and project management, seeking contributions that build on established lines of work, as well as on new research streams. Particularly seeking multidisciplinary and interdisciplinary perspectives, and focusing on currently emerging issues, the journal welcomes both pure and applied research that impacts theory and practice.

The journal content provides relevant information to researchers, practitioners, and organizations, and includes original qualitative or qualitative articles, as well as purely conceptual or theoretical articles. Due to the integrative and interdisciplinary nature of information systems and project management, the journal may publish articles from a number of other disciplines, including strategic management, psychology, organizational behavior, sociology, economics, among others. Articles are selected for publication based on their relevance, rigor, clarity, novelty, and contribution to further development and research.

Authors are encouraged to submit articles on information technology governance, information systems planning, information systems design and implementation, information technology outsourcing, project environment, project management life-cycle, project management knowledge areas, criteria and factors for success, social aspects, chief information officer role, chief information officer skills, project manager role, project manager skills, among others.

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The journal offers comprehensive coverage of information systems management and project management.

The topics include, but are not limited to:

- information technology governance
- information systems planning
- information systems design and implementation
- information technology outsourcing
- enterprise architecture
- information systems governance
- information systems department
- chief information officer role
- information technology leadership role
- chief information officer skills
- information systems management tools
- management of complex projects
- audits
- innovation
- ethics
- project environment
- project management life-cycle
- project initiation
- project planning
- project execution
- project control and monitoring
- project closing
- criteria and factors for success
- project manager role
- project manager skills
- portfolio management
- program management
- managing organization – structure
- tools and techniques
- project evaluation
- project management knowledge areas
- scope management
- time management
- cost management
- quality management
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- human resources management
- performance teams
- social aspects
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- managing organization – responsibilities
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Editorial

It is our great pleasure to bring you the forth number of the IJISPM - International Journal of Information Systems and Project Management. The mission of the IJISPM is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

In this issue, readers will find important contributions on project management practices, on ERP acceptance factors in organizations, and on the corporate digital divide phenomena.

The first article "Identifying useful project management practices: A mixed methodology approach" is presented by Gabriela Fernandes, Stephen Ward and Madalena Araújo. This article describes a mixed methodological research approach for identifying practitioner perceptions of the most useful project management (PM) practices to improve project management performance. By identifying the perceived most useful tools and techniques, as having the most potential for increased contribution to project management performance, practitioners and organizations can select their priorities when improving PM practices. The research involved thirty interviews with Project Management professionals in Portugal, followed by a global survey. The results showed that the top twenty of the list of the most useful tools and techniques is composed of very well-known and widely used tools, such as: progress report; requirements analysis; progress meetings; risk identification; and project scope statement. PM practices in the top of list cover the overall PM life cycle from initiation to project closing, but particular relevance is given to tools and techniques from planning. The areas of knowledge, scope, time, risk, communication and integration, assume a high relevance, each with at least three PM practices on the top of the list.

As Simona Sternad Zabukovsek and Samo Bobek state in their article "TAM-based external factors related to ERP solutions acceptance in organizations", to improve the efficiency and effectiveness of Enterprise Resource Planning (ERP) solutions use, understanding of critical success factors of ERP assimilation in organizations is crucial. The technology acceptance model (TAM) proposed by Davis (1989) has been the most widely used model for researching user acceptance and usage of information technology/information systems. The purpose of this paper is to extend the original TAM with groups of external factors which impact actual ERP system use. First, the authors focus on ERP system use in companies' maturity phase. Second, they expose and examine three groups of external factors which influence ERP usage. The model was empirically tested using data collected from a survey of ERP users in 44 organizations. Survey data have been collected from ERP users who have been exposed to an ERP system which has operated for more than one year. The proposed research model was analyzed using the PLS approach.

Mirjana Pejić Bach, Jovana Zoroja and Vesna Bosilj Vukšić are the co-authors of the article "Review of corporate digital divide research: A decadal analysis (2003-2012)". The digital divide (DD) refers to the gap between individuals, companies, regions and countries in accessing and using the information and communication technology (ICT). DD research is mainly oriented towards detection of differences in the ICT use among individuals. An important part of DD research refers to the differences in ICT adoption and use among corporations. The goal of this article is to present a review of published papers on DD among corporations. Papers from the journals indexed in SSCI that investigate corporate DD were examined in order to compare the research on corporate DD in terms of: (1) geographical area, time frame of the study, sampled corporations; (2) phenomena used as the indicators/measure of DD, inequality type, ICT adoption cycle, determinants of DD; and (3) data collection approach, data sources, sample size and methodology used for investigation of DD determinants.

We would like to take this opportunity to express our gratitude to the distinguished members of the Editorial Board, for their commitment and for sharing their knowledge and experience in supporting the IJISPM.

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Finally, we would like to express our gratitude to all the authors who submitted their work, for their insightful visions and valuable contributions.

We hope that you, the readers, find the International Journal of Information Systems and Project Management an interesting and valuable source of information for your continued work.

The Editor-in-Chief,

João Varajão

University of Minho

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João Varajão is currently professor of information systems and software programming at the *University of Minho* and a visiting professor at the *University of Porto Business School*. He is also a researcher of the *Centro Algoritmi* at the *University of Minho*. Born and raised in Portugal, he attended the *University of Minho*, earning his Undergraduate (1995), Masters (1997) and Doctorate (2003) degrees in Technologies and Information Systems. In 2012, he received his Habilitation degree from the *University of Trás-os-Montes e Alto Douro*. His current main research interests are in Information Systems Management and Project Management. Before joining academia, he worked as an IT/IS consultant, project manager, information systems analyst and software developer, for private companies and public institutions. He has supervised more than 50 Masters and Doctoral dissertations in the Information Systems field. He has published over 250 works, including refereed publications, authored books, edited books, as well as book chapters and communications at international conferences. He serves as editor-in-chief, associate editor and member of the editorial board for international journals and has served in numerous committees of international conferences and workshops. He is co-founder of CENTERIS - Conference on ENTERprise Information Systems and of ProjMAN – International Conference on Project MANagement.

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Identifying useful project management practices: A mixed methodology approach

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Identifying useful project management practices: A mixed methodology approach

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Abstract:
This paper describes a mixed methodological research approach for identifying practitioner perceptions of the most useful project management (PM) practices to improve project management performance. By identifying the perceived most useful tools and techniques, as having the most potential for increased contribution to project management performance, practitioners and organizations can select their priorities when improving PM practices. The research involved a programme of thirty interviews with Project Management professionals in Portugal, followed by a global survey. Completed questionnaires were received from 793 practitioners worldwide, covering 75 different countries. The results showed that the top twenty of the list of the most useful tools and techniques is composed of very well-known and widely used tools, such as: progress report; requirements analysis; progress meetings; risk identification; and project scope statement. PM practices in the top of list cover the overall PM life cycle from initiation to project closing, but particular relevance is given to tools and techniques from planning. The areas of knowledge, scope, time, risk, communication and integration, assume a high relevance, each with at least three PM practices on the top of the list.

Keywords:
project management practices; tools and techniques project; project management performance.

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1. Introduction

In the past thirty years project management (PM) has developed substantially as a discipline and significantly increased in visibility [1]-[3]. In order to manage business objectives, organizations are increasingly utilizing the discipline of PM [2],[4]. Business is becoming increasingly 'projectized' or project oriented [5]-[7], and 'management by projects' has become a powerful way to integrate organizational functions and motivate groups to achieve higher levels of performance and productivity [8]. However, demonstrating a concrete value of PM in organizations has been illusive and even paradoxical [9]. There is little research evidence to show that mastery of the PM 'body of knowledge' leads to improved project performance [10]. The actual value resulting from investments in PM has been hard to define and measure [11]. One of the difficulties is to isolate the return from PM and return from other management concepts [12].

Many methods, techniques and tools have been developed, covering all aspects of managing projects from their genesis to their completion [13]. Nevertheless, PM remains a highly problematical endeavor. Projects still fail to live up to the expectations of stakeholders as they continue to be disappointed by projects' results [14]-[17]. For instance, the Standish Group International [17] showed that, in the year 2008, only 32% of all the software projects surveyed succeeded (i.e. were delivered on time, on budget, with required features and functions); 44% were challenged (late, over budget and/or with less than the required features and functions), and 24% of projects failed (cancelled prior to completion or delivered and never used).

The research described in this paper aims to make some contribution in the identification of priorities for organizations when they chose to invest in improving project management performance by the use of specific PM practices. PM practices in this study are simply seen as those tools and techniques that practitioners use to "do the job" to "execute a PM process", such as work breakdown structure or a project charter. Tools and techniques are closer to the day-to-day practice, closer to the things people do, closer to their tacit knowledge [18]. The results presented here are part of a broader research study on the theme improving and embedding PM practices, in which the identification of most useful PM practices is one of five research questions of the study.

2. PM Tools and Techniques

PM tools and techniques are the mechanisms by which PM processes within the organization are delivered and supported. This includes, besides PM techniques (e.g. work breakdown structure or earned value management), the various guidelines in which the processes of the organization are defined, including the use of procedure documents, checklists, job aids, and templates, as well as, the use of software packages and various databases.

The proper use of PM tools and techniques should make it easier to implement PM principles [1]. For example, project management information system (PMIS) identified in the study by White and Fortune [2], as the most used tool and technique, is a tool that supports and facilitates the delivery of any project, particularly those which are complex, subject to uncertainty, and under market, time and money pressures, or other difficult to manage restrictions [3]. As argued by Stewart and Mohamed [4] "Without an effective use of information technology to facilitate the process of information management amongst project participants, it is unlikely that major improvements to the communication process will eventuate by continuing to use traditional paper-based process". Regarding PM software tools the market is populated with a wide range of them [5].

Several inputs can be used to guide an organization in selecting the most appropriate tools and techniques in a given context including various bodies of knowledge. The PM body of knowledge is the sum of knowledge within the profession of PM. The complete PM body of knowledge includes proven traditional practices that are widely applied, as well as innovative practices that are emerging in the profession [6]. The attempts by the bodies of Knowledge to systematize the knowledge required to manage projects are largely based on the underlying assumption that there are identifiable patterns and generalizations, from which rules, controls and guidelines for best practice can be established that are replicable, even if not on absolutely every circumstance [7]. PM Bodies of Knowledge have been published by

the professional PM associations in late 1990´s. There has been an emergence of multiple Bodies of Knowledge, such as:

- PMBoK® from Project Management Institute [8];
- APM BOK from Association for Project Management [9];
- ICB3.0 from International Project Management Association [10]; and
- P2M from Project Management Association of Japan [11].

These bodies of knowledge are used by practitioners as 'Best Practice' guides to what the discipline comprises [12]. The PMBoK®, APM BOK and P2M are of the most influential publications on what constitutes the knowledge base of the profession [13]. The three are not inconsistent, however the APM BOK and P2M, are much broader in conceptual breath and scope than the PMI PMBoK® [12].

Specific empirical studies have been conducted which identified the most used tools, for example the work from White and Fortune [2] and Besner and Hobbs [14]. White and Fortune [2] conducted a survey that was designed to determine the extent to which those involved in the management of projects actually make use of the methods and techniques that are available and how effective the methods and techniques used are felt to be. The authors listed 44 methods, methodologies, tools and techniques and asked the respondents to indicate which had been used in the project being considered to participate in the survey. The options chosen to be included in the list were those found in a selection of standard text books of PM (e.g. Kerzner [15]). From an analysis of 236 participants White and Fortune found that the most commonly used tools identified were: 'off the shelf' software (77% of the respondents); Gantt charts (64%); and cost benefit analysis (37%).

A more recent questionnaire survey undertaken in 2004 by Besner and Hobbs [14] surveyed views of 70 tools and techniques, with 753 respondents. Besner and Hobbs found that tools and techniques use levels varied considerably, from 1.4 to 4.1, based on a scale ranging from 1 (not used) to 5 (very extensive use). Table 1 lists the 70 tools and techniques included in Besner and Hobbs survey, in decreasing order by the level of usage, from top to bottom and left to right.

Besner and Hobbs [14] findings are consistent with the results from White and Fortune [2]. Although, Besner and Hobbs selected a larger number of tools and techniques, the three most used tools identified from White and Fortune are also in the top list of Besner and Hobbs (highlighted a 'bold' in the Table).

Beyond the perceptions of the most used tools and techniques, Besner and Hobbs [14] also studied an interesting variable - the 'intrinsic value of tools', which is the combination of the extent of use of the tools and techniques and the perceived potential contributions to project performance (intrinsic value = present extent of use + potential improvement). For the research study described in this paper, the more relevant information is about the 'intrinsic value' as we are looking for the most useful PM practices. Table 2 lists, from Besner and Hobbs [14], the twenty tools and techniques with the highest 'intrinsic value', in decreasing order from top to bottom and the tools and techniques with the lowest intrinsic value, which were "discredited" by Besner and Hobbs [14] as respondents indicated that these tools were rarely used and were perceived as having very little potential.

Based on continuing their process of data collection from 2004, the data was collected in three phases, in 2004, 2007, and 2009, respectively. In 2012, Besner and Hobbs [31] undertook a further study whose two main objectives were: to demonstrate that practitioners use PM tools and techniques in groups or "toolsets" and to compare the use of these "toolsets" among project types. This study showed that practice varies with the management of four different types of projects: engineering and construction; business and financial services; information and technology and telecommunications; and software development projects. Besner and Hobbs [31] 2012 results are based on a larger number of tools and techniques surveyed (108) compared with their 2004 survey. Most of the tools included in Besner and Hobbs' 108 tools' list and not in their 70 tools' list are applicable to portfolio management (e.g. graphic presentation of portfolio; project portfolio analysis; project priority ranking; multi criteria project selection or PM software for project portfolio analysis), which is beyond the scope of this research project. Additionally, this later study

did not study the attribute 'intrinsic value' of a tool and technique. Therefore, if any researcher or practitioner is looking for the most useful PM practices to manage a single project it would be better to look for results of the article Besner and Hobbs [29].

Table 1. The 70 tools identified by Besner and Hobbs [1] in decreasing order of level of usage

1. Progress Report	27. Critical path method analysis	50. Database for cost estimating
2. Kick-off meeting	28. Bottom-up estimating	51. Database for lessons learned
3. PM Software to task Scheduling	29. Team member performance appraisal	52. Product breakdown structure
4. Gantt chart	30. Team building event	53. Bidders conferences
5. Scope Statement	31. Work authorisation	54. Learning Curve
6. Milestone Planning	32. Self-directed work teams	55. Parametric Estimating
7. Change Request	33. Ranking of risks	56. Graphic presentation of risk information
8. Requirements analysis	34. Financial measurement tools	57. Life cycle cost (LCC)
9. WBS	35. Quality plan	58. Database of contractual commitment data
10. Statement of Work	36. Bid documents	59. Probabilistic duration estimate (PERT)
11. Activity list	37. Feasibility study	60. Quality function deployment
12. PM software to monitoring schedule	38. Configuration review	61. Value analysis
13. Lessons Learned/Post-mortem	39. Stakeholder analysis	62. Database of risks
14. Baseline plan	40. PM software for resources levelling	63. Trend chart or S-curve
15. Client acceptance form	41. PM software to monitoring of cost	64. Control charts
16. Quality inspection	42. Network diagram	65. Decision tree
17. PM software for resources scheduling	43. Project communication room (war room)	66. Cause-and-effect diagram
18. Project charter	44. Project Web site	67. Critical chain method and analysis
19. Responsibility assignment matrix	45. Bid/seller evaluation	68. Pareto Diagram
20. Customer satisfaction surveys	46. Database of historical data	69. PM software for simulation
21. Communication plan	47. PM software multi-project scheduling/levelling	70. Monte-Carlo analysis
22. Top-down estimating		
23. Risk management documents	48. Earned value	
24. Contingent plans	49. PM software Cost estimating	
25. Re-baselining		
26. **Cost/benefit analysis**		

Table 2. Tools with the highest and lowest 'intrinsic value' identified by Besner and Hobbs [1]

Highest 'intrinsic value'	**Lowest 'intrinsic value'**
1. PM software for task scheduling	1. Life cycle cost
2. Progress report	2. Graphic of risk information
3. Scope statement	3. Parametric estimating
4. Requirements analysis	4. Learning curve
5. Kick-off meeting	5. Quality function Deployment
6. Gantt chart	6. Value analysis
7. Lesson learned/post-mortem	7. Trend chart or S-curve
8. Change request	8. Critical chain method and analysis
9. PM software monitoring schedule	9. Control charts
10. Work breakdown structure	10. PERT analysis
11. Milestone planning	11. Cause-and-effect diagram
12. Statement of work	12. PM software for simulation
13. PM software resources scheduling	13. Pareto diagram
14. Risk management documents	14. Decision tree
15. Activity list	15. Monte Carlo analysis
16. Quality inspection	
17. Baseline plan	
18. Contingency plans	
19. Ranking of risks	
20. Client acceptance form	

3. Research methodology

Attending the research questions and the advantages and disadvantages of the main research methods, the research methodology chosen for this research was a mixed methodology approach, which includes two research instruments: semi-structured interviews and questionnaires. It was expected that the complementary strengths of semi-structured interviews and a questionnaire, namely the capability to get insights and opportunity for deeper additional data from the interviews [3], and the objectivity and potential for generalizable findings of the questionnaire [4], would help the process of identifying the most useful PM practices. Additionally, the triangulation of data would facilitate the validation of information [5].

Firstly, semi-structured interviews and qualitative data analysis were conducted in order to explore and identify the perceived most useful PM practices in different organizational contexts. Secondly, a survey questionnaire was administered, with the objective of getting views from more people and confirming or not the findings interviews.

4. The interviews study

4.1 Conducting and analysing the interview responses

For the first phase of the study, thirty semi-structured interviews were carried out in seven different organizations (industries, sizes, project types) as indicated in Table 3. Due to budget and time restrictions and personal privileged access, only personnel in Portuguese organizations were interviewed. The subjects had different roles in the organization - directors (17%), portfolio and programme managers (23%), project managers (53%) and team members (7%).

Table 3. Interviewed organization characterisation

Organization	Industry	Size	Number of Interviews
Organization 1	Research Centre	Small	5
Organization 2	Information Technology	Medium	3
Organization 3	Engineering and Construction	Large	4
Organization 4	Engineering and Construction	Medium	5
Organization 5	Telecommunications	Large	5
Organization 6	Information Technology	Small	4
Organization 7	Business Services	Small	4

The interviews were conducted between July and September 2012. Each interview lasted between one and three hours, the average was one hour and half. The interviews were conducted in-person at the interviewee's organization headquarters, except one that was conducted by video conference and five others by Skype call, because the interviewees spent most of their time at clients' sites.

The interview protocol related to the research question consisted of the following requests to interviewees: 1) Outline your experience in PM to date; 2) Characterize your organization in terms of business strategy and type of projects; 3) Tell stories of your organization initiatives to improve PM; 3) Identify the most useful PM practices that you use or have used; 4) Where appropriate, supplementary questions were used to prompt more detailed responses to the above questions. Although all participants had received by email a document giving an introduction to the study, each interview started with an introduction about the researcher's personal background, the research objectives, and the definition of some terms used in the study (e.g. PM practices, project management performance). Interview data was analyzed through thematic analysis [1] and application of Nvivo software.

4.2 Most useful PM practices interview results

Table 4 presents, in descending order, the PM practices most frequently identified by the interviewees as the most useful, with illustrative interviewee responses associated.

All the PM practices listed in Table 4 were stated by at least three or more interviewees (10% of the total interviewees). Other PM practices identified less often were: client acceptance form; customer satisfaction surveys; risk re-assessment; qualitative risk analysis; quantitative risk analysis; project issue log; work authorization; PM software to monitoring schedule; quality inspection; critical path method analysis; database of historical data; design of experiments; PM software to task scheduling; requirements traceability matrix; project web site.

The Nvivo software provides a facility for showing each items coded (PM practices) in terms of relative frequency of mentions by interviewees. The Nvivo 'map' (Fig. 1) presents the most useful PM practices identified as those more frequently suggested by interviewees. This rectangle presentation is automatically produced by Nvivo, which means for example the PM practice 'baseline plan' presented at the top left of the rectangle is the most mentioned and in the bottom right the least mentioned. In some rectangles of Nvivo 'map' the full text is not displayed - unfortunately, Nvivo 'map' facility does not allow users to format the text inside each rectangle.

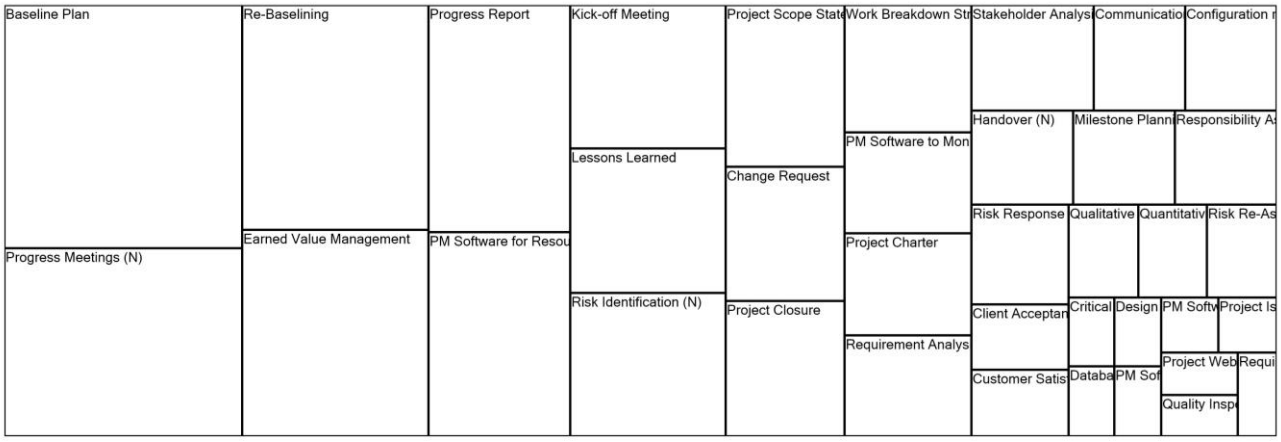

Fig. 1. Most useful PM practices compared by number of items coded

Table 4. Interviewee responses to the most useful PM practices

Most useful PM practices	**Some interviewee responses**
Baseline plan	"Project baselines for the control of scope, time, cost and quality." – (interviewee 1) "Detailed project plan. We make a little invest in planning, it is a cultural issue." – (interviewee 28)
Progress meetings	"Periodic progress meetings with the client and with the team, in order to communicate the difficulties and make decisions about the work in progress." – (interviewee 14) "Weekly progress meetings with the key project stakeholders in the organization." – (interviewee 19)
Re-baselining	"Continuous planning. Many times organizations make the big effort for the initial planning, but after don't make re-planning." – (interviewee 11) "Keeping the plan updated. Making an initial plan and then do not update it, doesn't serve for anything." – (interviewee 14)
Earned value management	"Earned Value Management is fundamental for my role. I can have the information of the project state with objective measures, without having to get involved in the project." – (interviewee 6)

PM software for resources scheduling	"Software for the management of human resources allocation, namely the % allocation of resources in different projects." – (interviewee 1) "Managing through software the allocation of shared resources." – (interviewee 23)
Progress report	"Progress reports, which includes the status report of each team member." – (interviewee 24)
Kick-off meeting	"Kick-off meeting for the analysis of the project's vicissitudes" – (interviewee 12) "Kick-off meeting with the team" – (interviewee 13)
Lessons Learned	"Registration of lessons learned throughout the project life cycle, not just at technological level, which is what has been happening, but more at a strategic level…" – (interviewee 23)
Risk identification	"Risk management. The project manager is 'bipolar', on one hand, he has to motivate the team, showing that they are capable of achieving the project's objectives, and on the other hand, he has to think and analyse everything that might run less well in the project. What are the project's risks?" – (interviewee 7)
PM software to monitoring cost	"Filling the timesheets." – (interviewee 22)
Project scope statement	"The detailed definition of the project scope. There would be always, or almost always, grey areas, but if at least we known them and we can anticipate them. This will solve many future problems." – (interviewee 10)
Work breakdown structure	"Scope definition using the Work breakdown structure." – (interviewee 29)
Project closure documentation	"Close reporting with variance analysis." – (interviewee 25)
Change request	"Change requests." – (interviewee 30)
Project charter	"Project charter. A document to formalize the project start." – (interviewee 26)
Stakeholder analysis	"Identification of the expectations of each involved in the project, named as stakeholders. Not only the customer, suppliers, the boss or the boss's boss…, but all those who, voluntarily or involuntarily, have or might have an influence during the project." – (interviewee 10)
Milestone planning	"Planning the major project milestones." – (interviewee 12)
Requirement analysis	"Clarification of the detailed requirements with the project stakeholders…" – (interviewee 14) "A template for gathering project requirements." – (interviewee 25)
Handover from the proposal team to the project team	"The 'transfer' of the proposal accepted by the customer to the project execution team, i.e., the transition of responsibility from the commercial manager to the project manager." – (interviewee 9)
Communication plan	"The development of the communication management plan." – (interviewee 11)
Responsibility assignment matrix	"RACI Matrix." – (interviewee 30)
Risk response plan	"Risk management, which involves both risk identification and planning responses. This practice must grow with the development of PM maturity level." – (interviewee 19)
Configuration review	"Documentation management, particularly for the control of documents changes and versions." – (interviewee 16)

5. The survey questionnaire study

5.1 Questionnaire data collection

For the second phase of the study, a worldwide on-line survey questionnaire was conducted. The questionnaire was divided into four parts. Parts A and B were used to answer different research questions of the study. Part C was a series of questions designed to investigate which are the most useful PM practices. As noted earlier, PM practices in this study are regarded as those tools and techniques that practitioners use to "do the job" to "execute a PM process". The part C questions concern the level of benefit that respondents consider they obtain using each PM practice on project management performance. Part D of the questionnaire gathered information about respondents, their experience and work context (e.g. industry, size, types of project, geographic location, role, PM experience, education level, gender and age).

Respondents were asked to answer only if they use or have used the PM practices. If not, respondents were asked to just tick the box 'not used'. In this way the researcher information was gathered from only respondents that have experience of each PM practice.

Each PM practice was rated on a 5-point Likert scale from 'very high' to 'very low'. The researcher had considered the use of a scale 1 to 4, in order to not give the respondent opportunity to choose the middle number in scale (3) and not take a position. However, since most people would expect one level at least separating points (2) - "low" and (3) - "high" of such a scale, the researcher adopted the 5-point Likert scale and decided to identify as the most useful PM practices those that rated on average at least 4.

The list of tools and techniques surveyed is the result from the interview analysis and complemented with the subset of 55 tools from 70 with the highest 'intrinsic value' (present extent of use + potential contribution to project performance if more or better used) from Besner and Hobbs [1], which almost half of the 55 tools and techniques (47%) were not identified by the interviewees. Although, only two tools and techniques: Gantt charts and activity list, in the top twenty of the highest 'intrinsic value', were not mentioned during the interviews. A total of 68 tools and techniques were surveyed. The tools were sorted to approximately follow the project life cycle, and in order to help respondents make clear distinctions, tools with similar names or related meanings were placed next to each other in the list.

Only one of the tools from the 55 tools with the highest 'intrinsic value' in Besner and Hobbs 2004 study [29], was not included - PM software for multiproject scheduling/levelling, because this research study is focused on tools to manage a single project.

The interview analysis only identified seven PM practices beyond the listed PM practices from Besner and Hobbs [1]:

- Progress meetings (the second most mentioned PM practice);
- Risk-reassessment;
- Project closure documentation;
- Handover (the proposal team to the project team);
- Requirements traceability matrix;
- Project management issue log;
- Design of experiments.

The researcher had also included in the questionnaire 5 of the 15 tools and techniques "discredited" by Besner and Hobbs [29]. This selection included those which had been "discredited" due to their limited extent of use, but which had been identified with potential contribution to project performance. As such they may be useful PM practices, which is what this study wants to find. Additionally, from the researcher professional experience, these are tools that bring high benefits to PM performance. They are:

- PM software for simulation;
- Critical chain method and analysis;
- Parametric estimating.

The other 2 "discredited" tools: Monte Carlo analysis and probabilistic duration estimate (PERT) analysis included in the questionnaire, although their limited extent of use and identified with limited potential contribution to project performance, the researcher professional experience and literature analysed pointed to the importance of these PM practices in a particular area of PM which is risk management [2]-[3]. The researcher understood that these tools are not extensively used, maybe because the knowledge required is high, thus inhibiting its use. However, this does not mean that they could not be useful PM practices.

Taking into account the responses obtained during the interviews, two tools - risk management documents and ranking of risk, from the Besner and Hobbs' study were rephrased for a better understanding from participants. They were rephrased to risk identification (one of the most identified PM practices by interviewees), qualitative risk analysis and quantitative risk analysis. With these three PM practices we get a better understanding of what risk management documents mean, and from the qualitative and quantitative risk analysis some risk ranking can be derived.

This research study has followed the distinction made by Besner and Hobbs [1] on the different functionalities of PM software, because, as Besner and Hobbs [1] has shown, the use of the different functionalities varies enormously. It is, therefore, inappropriate to consider PM software as a single tool with homogenous use. The decision to implement or support the use of PM software should take an approach that discriminates these varied uses.

Finally, two other PM practices: quality plan and close contracts were included in the questionnaire attending to the researcher's professional experience and the literature review [4],[5],[6], which the researcher want to understand from the practitioners' perspective if they are or not useful PM practices.

The questionnaire did not include a description of each PM practice, as the researcher just have interest in answers from people that use or have used the practice, therefore they should know their meaning. Also, adding even a brief description would have increased the length of the questionnaire.

5.2 Questionnaire population and sample

In academic research, any sample should be representative of the population and the sample size should take into account statistical significance and the anticipated response rate [7]. However, this research study used a non-probabilistic technique for sampling, the 'snowballing' technique. Therefore, there was no possibility of a predetermination of size of sample [8]. It was intended to cover PM practitioners over the world and the 'snowballing' sampling technique seems to be a suitable technique to pursue this objective.

In order to use the 'snowballing' technique it is necessary to have an initial list of contacts. The researcher gathered about 3.000 email contacts and used to advertise the questionnaire to the PM professional community. The contacts were from over one hundred different countries. Potential respondents were individually invited to complete the questionnaire sent out by email. Additionally, the researcher asked PM associations to advertise the survey to their members and invite them to consider taking part. From the 300 emails sent to different PM associations, about 10% supported this survey through advertisement on websites, newsletters, mailing to members and LinkedIn groups. Moreover, the survey was also accepted by the research program of PMI, which then had the possibility to post the survey directly on the website pmi.org. It was a lengthy questionnaire, which took around 15 to 20 minutes to complete. The questionnaire was available on-line between January and April 2013.

5.3 The dataset

Completed questionnaires were received from 793 practitioners worldwide, covering 75 different countries. The primary role of respondents was:

- Portfolio and programme manager: 19.9%
- Project manager: 42.9%
- Team member: 7.1%
- Functional manager: 6.3%
- Director: 16.2%
- Other: 7.6%

The countries with the highest participation were: Portugal (41%), United States (9%), United Kingdom (6%), Australia, Brazil and Netherlands (4%/ each), Canada, Italy, Spain and India (2%/ each). Participation is concentrated in these ten countries with 76% of the responses and the other sixty five countries with 24% of participation. The respondents were mostly between 30 and 50 years old (71.6%). Almost 50% of the respondents had more than 10 years of experience as a project manager and 15% had more than 10 years of experience as a portfolio or programme manager. They appear well qualified to provide valuable information. A vast majority had at least a postgraduate degree (83%), 33% had a postgraduate degree, 44% had a master degree and 6% a doctorate degree.

5.4 Most useful PM practices questionnaire results

Only 46% of the 793 respondents fully replied to this question, indicating that many respondents did not use or had not used some of the tools and techniques surveyed. The least used was the 'Monte-Carlo Analysis' and the 'PM software for simulation' with just 363 and 384 participants, respectively, indicating a level of benefit obtained on PM performance.

The following three Tables present the obtained rank in decreasing order of the most useful PM practices. Table 5 shows the top 20th most useful PM practices, Table 6 presents the most useful PM practices in the middle list, and Table 7 shows the bottom 20th most useful PM practices. Its examination reveals a variation in the perceived level of benefit that PM professionals obtain with the use of the specific tools and techniques on PM performance. For all tools and techniques the mean values range between 4.33 and 3.01. The median (the value above and below which half of the cases considered fall) is 4 for most of the tools and techniques (84%), as also the mode (the most frequent answer) is for 86% of the tools and techniques, which evidences the positive direction of respondents' answers. The standard deviations show low values (between 0.773 and 1.269) which indicate a low variability of answers.

The interpretation of these tables is straightforward. The tool perceived as the most useful is the 'progress report', while the one perceived as the least useful is 'Monte-Carlo analysis'. Curiously, exactly these two tools were identified by Besner and Hobbs [1] as the tools most and least used. This might indicate an expectable relation between the most used and the most useful tools and techniques.

As noted earlier, this study surveyed seven functionalities often served by PM software, Table 7 and 8 shows shaded in grey, that the seven functionalities of PM software surveyed vary greatly in their perceived level of benefit to PM performance. The 'PM software for task scheduling' and 'PM software to monitor schedule' are identified as the twenty-third and twenty-fourth most useful tools and techniques, respectively, while 'PM software for simulation' and 'PM software for resources leveling', are near the very bottom of the list. The other three functionalities - 'PM software to monitor cost', 'PM software for resources scheduling' and 'PM software for cost estimating', are in the middle of the list. Overall, the usefulness of PM software functionalities decreases for more complex usages.

Table 5. Statistical results of the 20th most useful PM practices

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
1. Progress report	771	22	4.33	4.00	5	.773
2. Requirements analysis	752	41	4.33	5.00	5	.870
3. Progress meetings	772	21	4.32	4.00	5	.802
4. Risk identification	753	40	4.30	5.00	5	.895
5. Project scope statement	750	43	4.24	4.00	5	.850
6. Kick-off meeting	768	25	4.21	4.00	5	.853
7. Milestone planning	752	41	4.20	4.00	4	.832
8. Work breakdown structure	753	40	4.18	4.00	5	.914
9. Change request	753	40	4.17	4.00	5	.887
10. Project issue log	713	80	4.11	4.00	4	.886
11. Gantt chart	759	34	4.11	4.00	5	.957
12. Activity list	743	50	4.10	4.00	4	.875
13. Client acceptance form	705	88	4.10	4.00	5	.995
14. Risk response plan/Contingent plans	730	63	4.05	4.00	5	1.019
15. Project statement of work	726	67	4.04	4.00	4	.941
16. Communication plan	741	52	4.03	4.00	4	.940
17. Responsibility assignment matrix	715	78	4.00	4.00	4	.947
18. Baseline plan	730	63	3.99	4.00	4	.976
19. Qualitative risk analysis	719	74	3.98	4.00	4	.962
20. Project charter	704	89	3.97	4.00	5	1.007

Table 6. Statistical results of the most useful PM practices in the middle list

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
21. Project closure documentation	745	48	3.93	4.00	4	.992
22. PM Software for task scheduling	716	77	3.91	4.00	4	1.034
23. PM software to monitor schedule	693	100	3.91	4.00	4a	1.046
24. Handover (the proposal team to the project team)	666	127	3.90	4.00	4	.985
25. Close contracts	664	129	3.88	4.00	4	1.013
26. Customer satisfaction surveys	705	88	3.87	4.00	4a	1.080
27. Stakeholder analysis	722	71	3.85	4.00	4	1.045
28. Lessons learned	739	54	3.85	4.00	4a	1.100
29. Product breakdown structure	649	144	3.84	4.00	4	1.016
30. Critical path method analysis	694	99	3.80	4.00	4	1.094
31. Re-baselining	688	105	3.79	4.00	4	1.008
32. Project communication room (war room)	616	177	3.78	4.00	4	1.047
33. Bottom-up estimating	676	117	3.76	4.00	4	.987
34. Requirements traceability matrix	616	177	3.76	4.00	4	1.046
35. Quantitative risk analysis	675	118	3.75	4.00	4	1.076
36. Feasibility study	653	140	3.72	4.00	4	1.029
37. PM software to monitor cost	627	166	3.71	4.00	4	1.142
38. PM software for resources scheduling	678	115	3.71	4.00	4	1.105
39. Bid documents	637	156	3.70	4.00	4	.978
40. Cost/benefit analysis	697	96	3.70	4.00	4	1.053
41. Risk re-assessment	675	118	3.69	4.00	4	1.087
42. Quality inspection	695	98	3.65	4.00	4	1.010
43. Financial measurement tools (eg. ROI , NPV)	675	118	3.64	4.00	4	1.071
44. Top-down estimating	672	121	3.64	4.00	4	1.037
45. Team building event	699	94	3.62	4.00	4	1.052
46. Work authorisation	637	156	3.61	4.00	4	.970
47. Self-directed work teams	626	167	3.60	4.00	4	1.021
48. Quality plan	716	77	3.56	4.00	4	1.042

a- Multiple modes exist. The smallest value is shown.

Table 7. Statistical results of the bottom 20th most useful PM practices

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
49. Bid/ seller evaluation	589	204	3.54	4.00	4	1.047
50. Team member performance appraisal	660	133	3.53	4.00	4	1.034
51. Earned value management	605	188	3.51	4.00	4	1.163
52. PM software for cost estimating	625	168	3.50	4.00	4	1.163
53. Database of risks	566	227	3.49	4.00	4	1.109
54. Network diagram	609	184	3.46	4.00	4	1.162
55. Project Web site	636	157	3.44	3.00	3	1.097
56. Critical chain method and analysis	468	325	3.44	4.00	4	1.153
57. Database of contractual commitment data	525	268	3.43	4.00	4	1.081
58. Database for cost estimating	524	269	3.43	4.00	4	1.115
59. Database of lessons learned	660	133	3.42	3.00	3	1.183
60. Configuration review	593	200	3.39	3.00	3	1.035
61. Parametric estimating	508	285	3.38	3.00	3	1.062
62. PM software for resources levelling	623	170	3.38	3.00	3	1.195
63. Database of historical data	595	198	3.33	3.00	3	1.081
64. Probabilistic duration estimate (PERT)	533	260	3.30	3.00	4	1.201
65. Design of experiments	505	288	3.29	3.00	3	1.091
66. Bidders conferences	489	304	3.27	3.00	3	1.093
67. PM software for simulation	384	409	3.08	3.00	3	1.269
68. Monte-Carlo analysis	363	430	3.01	3.00	3	1.230

The top twenty of the list of the most useful tools and techniques (mean ≥ 4.0) is composed by very well-known and widely used tools. There are few surprises here. Fig. 2 shows that the practices acknowledged cover the overall PM life cycle from initiation to project closing, although particular relevance is given to tools and techniques from planning. The areas of knowledge - scope, time, risk, communication and integration, assume a high relevance amongst the most useful PM practices, each with at least three PM practices on the top of the list. For example, under the risk management practices were identified: 'risk identification'; 'risk response plan'; and 'qualitative risk analysis'. Curiously, none of the tools from the area of cost or quality, related usually to the project's objectives, are in the top of the list.

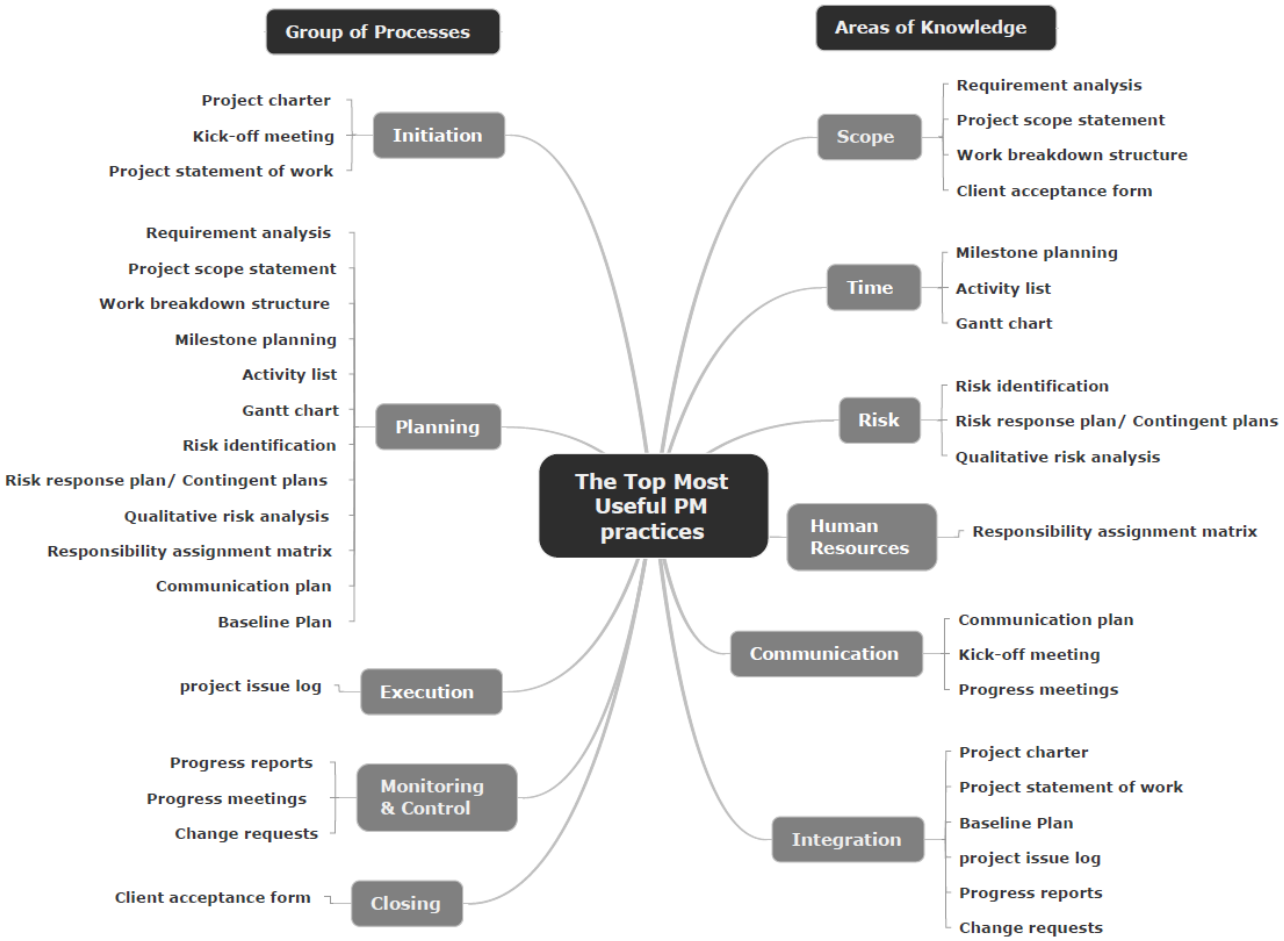

Fig. 2. The top twenty most useful PM practices by group of processes and areas of knowledge

The set of the top most useful PM practices identified from the survey (Table 5) is largely similar to the set identified from the interviewees (Table 4). However, on the survey results other PM practices got more significance as: project issue log; Gantt chart; client acceptance form; activity list; project statement of work; and qualitative risk analysis.

This research had hypothesized that the concept studied by Besner and Hobbs [1], 'intrinsic value' of a tool and technique corresponds to the concept investigated by this research of 'most useful' PM tools and techniques. The survey results showed that fifteen of the twenty most useful tools and techniques identified in the survey (Table 5) are the same identified by Besner and Hobbs [1] with the highest 'intrinsic value' (Table 2). Table 8 shows the differences between the positions from the Besner and Hobbs' list and the results of this study. For example, 'client acceptance form' is positioned in the thirteenth position and in Besner and Hobbs' study assumes a lower position (20^{th}).

Table 8.Comparisons between the 20th most useful PM practices with 20th 'highest intrinsic value' from Besner and Hobbs [1]

PM Practices	**Position in this study**	**Position in Besner & Hobbs' study**
Progress report	1st	2nd
Requirements analysis	2nd	4th
Progress meetings	3rd	Not included
Risk identification	4th	14th
Project scope statement	5th	3rd
Kick-off meeting	6th	5th
Milestone planning	7th	11th
Work breakdown structure	8th	10th
Change request	9th	8th
Project issue log	10th	Not included
Gantt chart	11st	6th
Activity list	12nd	15th
Client acceptance form	13rd	20th
Risk response plan/Contingent plans	14th	18th
Project statement of work	15th	12nd
Communication plan	16th	-
Responsibility assignment matrix	17th	-
Baseline plan	18th	17th
Qualitative risk analysis	19th	19th
Project charter	20th	-

Two of the tools and techniques, not included in Besner and Hobbs [1] study, but identified by the interview data analysis as most useful PM practices - 'progress meetings' and 'project issue log', were positioned in top positions, the third and tenth position, respectively. The tools and techniques 'communication plan', 'responsibility assignment matrix' and 'project charter', are in the middle of the list of Besner and Hobbs' study.

Several reasons may explain the presence of a tool on the bottom of the list. Individuals can use some tools without any organizational investment or support. For example, the use of a project charter or a Gantt chart does not require any specialized resources. However, the use of databases does require significant organizational resources and support, and these tools may not be used properly, or fully used, because of the lack of resources and support, for respondents to perceive their level of benefit. Most of the tools and techniques on the list have been in wide circulation for over 15 years with the exception of, for example, the critical chain method. The relatively recent arrival of such tools on the PM scene may, at least partially, explain their low usage levels (selection of 'not used') and the perceived level of benefit.

6. Conclusion

This paper contributes to professional community by setting priorities for improving PM performance. Organizations and practitioners can identify ways to develop and enhance their PM practices by examining the tools and techniques identified in this study as the most useful to increase PM performance.

Firstly, semi-structured interviews and qualitative data analysis were conducted in order to explore and identify the perceived most useful PM practices from different organizational contexts. Secondly, a survey questionnaire was administered, with the objective of getting views from more people and confirming or not the findings from interviews. A total of 68 tools and techniques were surveyed. Only 46% of the 793 respondents fully replied to the 68 tools and techniques, indicating a level of benefit obtained on PM performance. The results show a variation in the perceived level of benefit that PM professionals obtain with the use of the specific tools and techniques on PM performance. For all tools and techniques the mean values range between 4.33 and 3.01. The median is 4 for most of the tools and techniques (84%), as also the mode is for 86% of the tools and techniques, which evidences the positive direction of respondents' answers. The standard deviations show low values which indicate a low variability of answers. The tool perceived as the most useful is the 'progress report', while the one perceived as the least useful is 'Monte-Carlo analysis'. The set of the top most useful PM practices identified from the survey (Table 5) were largely similar to the set identified from the interviewees (Table 4). However, on the survey results other PM practices get also high significance as: project issue log; Gantt chart; client acceptance form; activity list; project statement of work; and qualitative risk analysis.

One important issue in PM is that is highly contingent on the organizational context, such as structure of business or industry sector, size, and its environment [41], [11]. As argued by Besner and Hobbs [18] "There is a widespread recognition of the variability of PM practice by project type and by application area and other contextual factors". The research is progressing, analyzing the quantitative data in order to find if the most useful PM practices are dependent on the organizational context (e.g. industry, size, project types and geographic location). The question deals with the identification of which practices differ in which contexts, and what future developments in PM practice do these results suggests.

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TAM-based external factors related to ERP solutions acceptance in organizations

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Abstract:
To improve the efficiency and effectiveness of ERP solutions use, understanding of critical success factors of ERP solutions assimilation in organizations is crucial. The technology acceptance model (TAM) proposed by Davis (1989) has been the most widely used model for researching user acceptance and usage of IT/IS. The purpose of this paper is to extend the original TAM with groups of external factors which impact actual ERP system use. First, we focus on ERP system use in companies' maturity phase. Second, we expose and examine three groups of external factors which influence ERP usage. The model was empirically tested using data collected from a survey of ERP users in 44 organizations. Survey data have been collected from ERP users who have been exposed to an ERP system which has operated for more than one year. The proposed research model was analyzed using the PLS approach.

Keywords:
Enterprise Resource Planning (ERP); Technology Acceptance Model (TAM); Partial Least Squares (PLS); maturity model; work compatibility.

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1. Introduction

Enterprise resource planning (ERP) solutions can be viewed as: (1) a set of packaged application software modules, with an integrated architecture, that can be used by organizations as their primary engine for integrating data, processes, and IT in real time across internal and external value chains; (2) deep knowledge of business practices that vendors have accumulated and stored from implementations in a wide range of client organizations and that can exert considerable influence on the design of processes within new client organizations; and (3) a generic 'semi-finished' product with tables and parameters that client organizations and their implementation partners must configure, customize, and integrate with other computer-based IS to meet their business needs [1]. These solutions are "web enabled", meaning they work using web clients; this makes them accessible to all of the organization's employees, clients, partners, and vendors at any time and from anyplace, thereby promoting the business units' effectiveness [2]. The ERP solution's goal is to make information flow be both dynamic and immediate, thereby increasing the usefulness and value of the information. In addition, an ERP solution acts as central repository eliminating data redundancy and adding flexibility. In summary, ERP solutions are the mission-critical IS in today's business organizations and solve the critical problem of integrating information from various sources both inside and outside the organization's environment to make it available in real time to all employees and partners of the organization.

Ross, Vitale, and Willcocks [3] identified five stages ERP solutions lifecycle: (1) design; (2) implementation; (3) stabilization; (4) continuous improvement (maturity stage); and (5) transformation. In the ERP design stage, organizations make two important design decisions: one about process change and another about process standardization. In the implementation stage, organizations carefully plan implementation, deploying implementation teams to train users on the new solution and, to some extent, on new processes. Most found that "going live" tended to be highly disruptive as the new solution tended to be linked to new processes. However, it was not possible to implement the new solution and the new processes separately because they were highly interdependent. Consequently, "going live" introduced major organizational changes. In most cases, managers involved with implementations have found they had underestimated the extent to which individuals would be affected. A period of stabilization often immediately follows implementation, during which time the organization attempts to clean up its processes and data and adjust to the new environment. The typical stabilization period for an initial implementation is 4 to 12 months. For this stage, it is usual that an initial performance dip occurs, although the intensity and length of organizations' performance dips vary. Following stabilization, organizations enter a maturity stage in which they add functionality through new modules. During this stage, organizations are focused primarily on continuous improvement, but they are also starting to engage in process redesign to implement new structures and roles to leverage the solution. The transformation stage involves changing organizational boundaries, particularly with regard to solutions, which means the extension of the ERP into customer and supplier solutions.

ERP solutions have been implemented in most organizations recently, but it seems that majority of companies are unable to point out the most important contributions of their ERP systems. Supposedly, the use of ERP solutions significantly reduces the time to complete business processes and helps organizations share information [4]. Generally offer a better work environment for their users as they are given a more efficient system with which to work. However, instead, ERP systems have been plagued with high failure rates and an inability to realize the promised benefits [5]. Much of the success of ERP implementation lies in the operational phase of the ERP solution lifecycle. After the stabilization stage, companies enter a maturity stage during which time they should put more effort into people and process improvements [6]. In this stage, users accept the system, and the usage becomes a regular day-to-day activity. It often takes many months or even years for experienced users to become comfortable with the ERP system. However, at some point in the ERP system's life, users begin to see its advantages and they then begin to explore its functions, gradually reaching success. This process demonstrates that ERP users have accepted the ERP system and are putting it to extended use. The impact of ERP systems on users and their acceptance have been recognized as key factors of ERP implementation success.

To improve the efficiency and effectiveness of ERP system use, organizations need to research the factors that impact user satisfaction. In this area, the technology acceptance model (TAM) is one of the most widely used models for explaining the behavioral intention and actual usage and can improve our understanding of how influence on actual usage could help increase efficiency and effectiveness of ERP system use [7]. A review of the literature indicates that, in recent years, only a few studies examining users' adoption of ERP systems through TAM have been published (for the latest research, see [4],[7]-[10]. However, all of them examine a few contextual factors that influence the intention to use an ERP system or ERP use in the stabilization stage. In addition, very few studies have been conducted regarding technology acceptance of ERP systems, especially those dealing with autonomous ERP users (i.e., [9]). Through their scientific work, researchers have recognized that the generality of TAM and their research of small numbers of additional factors that impact TAM fail to supply more meaningful information on users' opinions about a specific system - especially an ERP system, which is considered a strategic IS in organizations. Therefore, the need exists to incorporate additional factors or integrate it with other IT acceptance models for improvement of its specificity and explanatory utility (i.e., [11],[12]).

The purpose of this paper is to extend the original TAM with groups of external factors which impact actual ERP system use. Survey data have been collected from ERP users who have been exposed to an ERP system which has operated for more than one year. The proposed research model is analyzed using the PLS approach. The rest of this paper is organized as follows: a literature review; an enterprise resource acceptance model; methodology; results and analysis; discussion; and then the conclusion.

2. Literature Review

2.1 Technology Acceptance Model (TAM)

Several theoretical models have been used to investigate the determinants of acceptance and use of new information technology (IT), such as the theory of reasoned action (TRA; [13]), the theory of planned behavior (TPB; [14]), and the theory of the technology acceptance model (TAM; [15]). Compared to competing models, TAM is believed to be more parsimonious, predicative, and robust ([12],[16],[17]); consequently, among the theoretical models, it is the most widely used by IS/IT researchers ([4],[15],[18],[19]). The key purpose of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions [15].

TAM posits that two beliefs - perceived usefulness (PU) and perceived ease of use (PEOU) - are of primary relevance for computer acceptance behavior [15]. PU is defined as 'the degree to which a person believes that using a particular system would enhance his or her job performance' ([19], p. 320). In contrast, PEOU refers to 'the degree to which a person believes that using a particular system would be free of effort' ([19], p. 320). The two central hypotheses in TAM state that PU and PEOU positively influence an individual's attitude towards using a new technology (AT), which in turn influences his or her behavioral intention (BI) to use it. Finally, intention is positively related to actual use (AU). TAM also predicts that PEOU influences PU; as Davis et al. ([15], p. 987) explained, 'effort saved due to improved perceived ease of use may be redeployed, enabling a person to accomplish more work for the same effort'.

2.2 TAM and ERP systems

A review of past ERP studies regarding TAM indicates that few studies have investigated ERP user acceptance and usage, and only a small number of articles have been published. Furthermore, all of them expose small numbers of external factors which could influence ERP acceptance and usage in different phases of an ERP system lifecycle (see Table 1). As several studies (i.e., [20],[21]) have revealed, a common reason for ERP failures can be attributed to users' reluctance and unwillingness to adopt and use the implemented ERP system. A better understanding of the factors leading ERP users' acceptance of ERP systems is necessary to facilitate successful ERP usage [20]. In the current study, we aim to identify factors leading users to better use of their ERP system. Thus, the goal of our research is to expand the basic TAM with more generic contextual factors and examine their influence on perceived ERP usefulness and

perceived ERP ease of use. Studying the influence of external factors on constructs not only contributes to the theory development, but also helps in designing interventional programs for organizations.

Table 1. ERP Literature on TAM

Focus	**Phase–ERP system lifecycle**
They examined factor organizational support (formal and informal) on original TAM factors [4].	Post-implementation
They examined the formation of readiness for change (enhanced by two factors: organizational commitment and perceived personal competence) and its effect on the perceived technological value of an ERP system leading to its use [5].	Post-implementation (stabilization stage)
Their study attempted to explain behavioral intention and actual use through incorporated additional behavioral constructs: top management support, computer self-efficacy, and computer anxiety [7].	Post-implementation (maturity stage)
They examined factors (subjective norms, compatibility, gender, experience, and education level) that affect users' behavioral intention to use an ERP system based on potential ERP users at one manufacturing organization [8].	Implementation
They extended IT usage models to include the role of ERP's perceived work compatibility in users' ERP usage intention, usage, and performance in work settings [9].	Post-implementation (maturity stage)
They researched impact of PEOU, result demonstrability, and subjective norm on PU and impact of it on usage behavior [10].	Post-implementation (stabilization stage)
They tested the impact of four cognitive constructors (PU, PEOU, perceived compatibility, and perceived fit) on attitude toward using ERP system and symbolic adoption [17].	Post-implementation (stabilization phase)
Their study evaluated the impact of one belief construct (shared beliefs in the benefits of a technology) and two technology success factors (training and communications) on PU and PEOU in one global organization [18].	Implementation
They researched student readiness for change (through gender, computer self-efficacy, and perceived benefits of ERP) on behavioral intention regarding ERP implementation [22].	Implementation
They investigated via case studies the relationship between training satisfaction and the PEOU, the PU, effectiveness, and efficiency in implementing an ERP system at a mid-sized university [23].	Implementation
They researched the impact of PU and PEOU on extended use [24].	Post-implementation (maturity stage)
They developed a research model based on TAM for testing the influence of the critical success factors (top management support, communication, cooperation, training, and technological complexity) on ERP implementation [25].	Implementation
They extended TAM to research the selection of ERP by organizations using factors: impact of system quality, information quality, service quality, and support quality as key determinants of cognitive response as well as which ERP system to purchase/use [26].	Selection
He investigated the influence of personal innovativeness on general computer self-efficiency and PEOU, cultural orientation (power distance and collectivism) on PU, and impact of PEOU and PU on ERP personal innovativeness on intention to use) [27].	Implementation
They research the impact of change management on perceived benefits for user, user training and education's influence on benefits for organization, benefits of organization and benefits of user on financial performance, financial performance on ERP adoption [28].	Implementation

2.3 External factors

Research efforts have been devoted to extend the theory by examining the antecedents of PU and PEOU. As noted by Venkatesh and Davis [17], a better understanding of these factors would enable us to design effective organizational interventions that might lead to increased user acceptance and use of new IT systems.

Over the last two decades, substantial empirical support has emerged in favor of TAM (see [29]). Although TAM is a model applicable to a variety of technologies, the constructs of TAM need to be extended by incorporating additional factors [8]. Schwarz [30] reviewed identified antecedents to cognitive factors (PEOU and PU) and categorized the factors into three groups: individual variable (such as computer experience, self-efficacy, and prior experiences), organizational influences (such as management and external support and perceived resources), and technology characteristics (such as accessibility of the medium and interface type).

Meanwhile, Venkatesh and Bala [29] exposed four different types of determinants of PU and PEOU: individual differences, system characteristics, social influence, and facilitating conditions. In the context of ERP systems, in prior research we exposed that external factors include three groups of factors: personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational-process characteristics (OPC).

Personal characteristics and information literacy (PCIL) includes personality characteristics that can influence individuals' perceptions of ERP system acceptance and usage. PCIL factors include:

- Experience with computer is a determinant factor of behavior and has been found to be important factor for the acceptance of a technology [8];
- Computer self-efficiency is defined as the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer ([7],[29]);
- Personal innovativeness toward IT. According to the innovation diffusion theory [31], people react differently to a new idea, practice, or object due to their differences in individual innovativeness, a predisposed tendency toward adopting an innovation. Personal innovativeness toward IT represents the degree to which an individual is willing to try out a new IT [11]);
- Computer anxiety represents degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" ([17], p. 349). Individuals with lower anxiety are much more likely to interact with computers than people with higher anxiety [7].

In contrast to most IT implementation research, the fact that ERP implementation research is focused on one technology has enabled the effect of specific technological characteristics to be examined. A lack of attention to system and technological characteristics is a serious deficiency in most IT implementation research. We have not found any research that has examined system and technology characteristics (SCT) upon the ERP system user acceptance. Surveying different studies of external factors has exposed:

- Data quality. ERP provides easy access to corporate data, but if the data are inaccurate or irrelevant to the business processes in the subunit, there will be few benefits. Thus, without accurate and relevant data, an organization is severely constrained in the coordination and task efficiency benefits it can achieve from its ERP system [32];
- ERP system functionality. System functions are used to measure the rapid response, stability, easy usage, and flexibility of the ERP system [33];
- ERP system performance refers to the degree to which a person believes that a system is reliable and responsive during a normal course of operations [18];
- User manuals (help) refer to the degree to which an ERP users views inadequate users manuals and help as the reason for one's unsuccessful ERP performance [34].

Organizational-process characteristics (OPCs) capture various social processes and mechanisms and support organizations that guide individuals to facilitate the use of an ERP system. OPCs include:

- Social influence which joins two factors: subjective norm and social factors. Subjective norm is defined 'as a person's perception that most people who are important to him/her think that he/she should or should not perform the behavior in question' [35]. Social factors are 'individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others in specific social situations' [36];
- Fit with business processes. ERP packages are built around best practices in specific industries [37]. But the software may not necessarily fit the operating practices of an adopting organization. Nah et al. defined perceived fit from an end-user's perspective as the degree to which the ERP system is perceived by a user to meet his/her organization's needs [20];
- Training and education on ERP system is an important component in ERP implementation projects and is recommended before, during, and after implementation [25]. Training and education on an ERP system are defined as the degree to which the user thinks that he/she has had enough formal and informal training after ERP implementation;
- ERP support. In an ERP system environment, if the organization provides sufficient support to ERP users for their tasks, they are more likely to enjoy their work and improve their performance through usage of the ERP system [4]. ERP support is defined as the degree to which an individual views adequate ERP support as the reason for his or her successful ERP usage;
- ERP communication problems refer to the lack of communication regarding the ERP applications and their modifications [34]. As a result, ERP communications has been defined as the degree to which an individual views sufficient communication regarding the ERP system as the reason for his or her successful ERP usage.

In summary, because of the high rate of ERP implementation failure, more research in the area of technology acceptance is needed [10]. The original TAM is well established and tested; furthermore, a variety of extensions have been developed in different IT environments. Regardless of ERP complexity and ERP implementation failure, very few studies have been conducted regarding technology acceptance, especially with regard to more external factors of ERP usefulness and ERP ease of use. Our study will contribute to the body of knowledge in this specific area.

2.4 Work Compatibility

In case of ERP implementations, other cognitive considerations beside perceived usefulness (PU) and perceived ease of use (PEOU) may become relevant [20]. In the ERP context, organizations have to adopt business processes of an implemented ERP system. Although one of the major benefits of ERP systems is that they offer to organizations solution with best business practices it is not necessary that this is the best options for ERP users. Inherent business rules behind the processes gives them little choice but to follow strict business processes of ERP system, unlike the old system, which allowed them many different processes variations [38]. So organizations deploy ERP systems to facilitate organizational work rather than to match users' personal preferences or habits. At this presume we view work compatibility (WC) strictly as the fit of ERP to organizational work, and not to personal preferences or work habits. Work compatibility, like perceived ERP usefulness (PU) and perceived ERP ease of use (PEOU), is very much a perceptual construct as it is the perception of fit between IT and work that motivates employees to use the system, irrespective of the actual extent of fit [39]. ERP work compatibility (WC) refers to "degree" to which can ERP user do most of their tasks in ERP system. Work compatibility (WC) influences perceived ERP usefulness (PU) and so it demonstrates the importance of incorporating work compatibility in models of IT usage as exposed i.e. Sun et al. (2009) and [40].

3. Enterprise Resource Acceptance Model

To examine ERP users' use of ERP systems, we need to extend the TAM model. Synthesizing prior research on TAM and research on ERP systems, a conceptual model that represents the cumulative body of knowledge from TAM and ERP research over the years has been developed (see Fig. 1). The grey area within the dotted line denotes the original TAM. Because our research is focused on a group of external factors which influence the current usage of ERP system in the routine stage, there is no need to examine the behavioral intention on use and actual use; thus, behavioral intention and actual use were dropped from purposed research model.

According to Davis perceived ease of use influences perceived usefulness while both perceived usefulness and perceived ease of use influence attitude toward using the system [19]. Therefore, the following hypotheses were proposed:

H1: Perceived ERP ease of use (PEOU) has positive and direct effect on perceived ERP usefulness (PU).

H2: Perceived ERP ease of use (PEOU) has positive and direct effect on attitude toward ERP system (AT).

H3: Perceived ERP usefulness (PU) has positive and direct effect on attitude toward ERP system (AT).

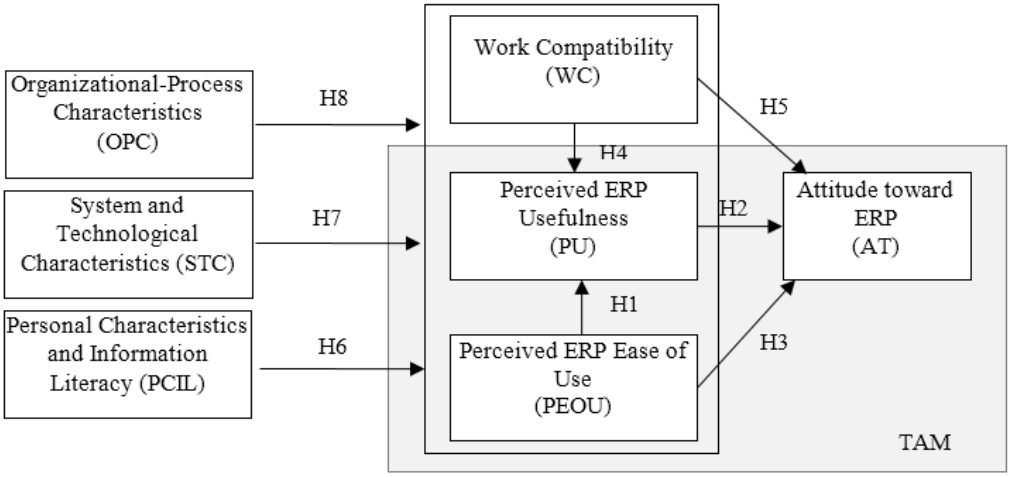

Fig. 1. Conceptual Model

In a context of ERP usage it is expected that relationship between work compatibility (WC) and perceived ERP usefulness (PU) as the more work compatible ERP system is, the more useful it is for ERP users. It can be argued that:

H4: Work compatibility (WC) between their organizational tasks and an ERP system is positively related to their usefulness (PU) of ERP usage.

We also presume that work compatibility (WC) has strong direct effect on Attitude toward using ERP system (AT), not just indirect effect through ERP usefulness as if ERP users believe that ERP system is more work compatible with their daily tasks, they will have more positive attitude toward using that system. Research with these relationships could not be found therefore these two hypotheses have been proposed:

H5: Work compatibility (WC) has direct positive effect on Attitude toward using ERP system (AT).

The problem of TAM research is that most researchers investigate small numbers of external factors that influence user acceptance and usage. In the context of ERP systems, more external factors exist that can influence users' acceptance. Thus, the conceptualization of higher-order factors (in our case second-order factors), in which more external factors jointly have to be included, have to be investigated if we want to extend our understanding of user behavior in ERP settings. On that presumption we hypothesize:

H4: A group of external factors influence use of the ERP system through the conceptual factor personal characteristics and information literacy (PCIL).

H5: A group of external factors influence use of the ERP system through the conceptual factor system and technological characteristics (STC).

H6: A group of external factors influence use of the ERP system through the conceptual factor organizational-process characteristics (OPC).

4. Research Methodology and Results

4.1 Research methodology

We tested our hypotheses empirically using a field survey of users of ERP systems in the maturity stage. Organizations were selected using two criteria: (1) the organizations must have implemented one of the two most popular global ERP solutions in Slovenia: SAP or Microsoft Dynamics; and (2) the organizations must have used the ERP system for more than one year at the time of the study. The initial e-mail explaining the purpose of the study was sent to a total of 122 companies. Each organization was required to verify that it matched our selection criteria; 44 organizations agreed to participate in the survey and were asked to distribute the survey questionnaire to their ERP users. All respondents were required to have used an ERP system in their daily work. Ultimately, 293 questionnaires were properly filled out by respondents and used for the purpose of analysis.

The constructs of the purposed model - perceived ERP usefulness, perceived ERP ease of use, work compatibility and attitude toward ERP use for basic TAM of ERP systems - are influenced by constructs of external variables. The constructs of external variables are distributed among three second-level constructs: personal characteristics and information literacy (PCIL); system and technological characteristics (STC); and organizational-process characteristics (OPC). PCIL includes experience with computer, computer self-efficiency, personal innovativeness toward IT, and computer anxiety. STC includes ERP data quality, ERP system functionality, ERP system performance, and user manuals (help). OPC includes social influence, fit with business processes, ERP training and education, ERP support, and ERP communication. Thus, our model includes 17 first-order factors and three second-order factors.

All the items of factors were measured on a 7-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'; the scale was adopted from relevant prior research and adapted to relate to the context of ERP usage. In addition, demographic information was collected. The instrument was pilot tested with a group of 30 ERP users in one organization. Based on the results of the pilot testing, revisions and additions were made to the instrument. Pilot participants were included in the main data gathering effort since they were part of the population of interest.

Models, which include second-order factors, consist of higher-order factors that are modeled as causally impacting a number of first-order factors (i.e., standard factors with measured indicators; [41]). Therefore, these second-order factors are not directly connected to any measurement items. The partial least squares (PLS) approach allows the conceptualization of higher-order factors by repeated use of manifest variables [42]. The empirical data were analyzed in two stages involving a PLS technique, using Smart PLS 2.0 M3 [43]. In the first stage, all measurement scales were examined for their psychometric properties; the second stage focused on hypothesis testing and analysis. Path significance was estimated using bootstrapping resampling techniques with 500 sub-samples. Detailed results and analyses can be obtained from the authors.

4.2 Results

As previously indicated, 293 questionnaires were properly filled out by respondents from 44 organizations and used for the analysis. Survey respondents represented different groups of industries, including IT and telecommunications (44.0%), manufacturing (35.2%), professional, scientific and technical activities (10.2%), wholesale and retail trade (4.1%), and others (6.5%). Respondents were 51.5% male and 48.5% female. Most (67.2%) had a high school education or more. More than half (53.6%; 157 respondents) indicated that they were workers (experts and other employees); others indicated low management (e.g. manager of group or organization unit), middle management (e.g., CIO) or corporate government and/or top management. The average total working years was 15.4 years, and average working years at their current workplace was 7.6 years. The ERP system had been used for 4.73 years, on average. The final version of model is presented in Fig. 2. Because all of the external factors did not meet assessment requirements of the measurement model, we excluded them from further analysis. These external factors included computer self-efficacy and experience with computer from PCIL group, ERP functionality from STC group and ERP support, ERP communications and ERP training, and education from OPC group (dotted shapes in Fig. 2).

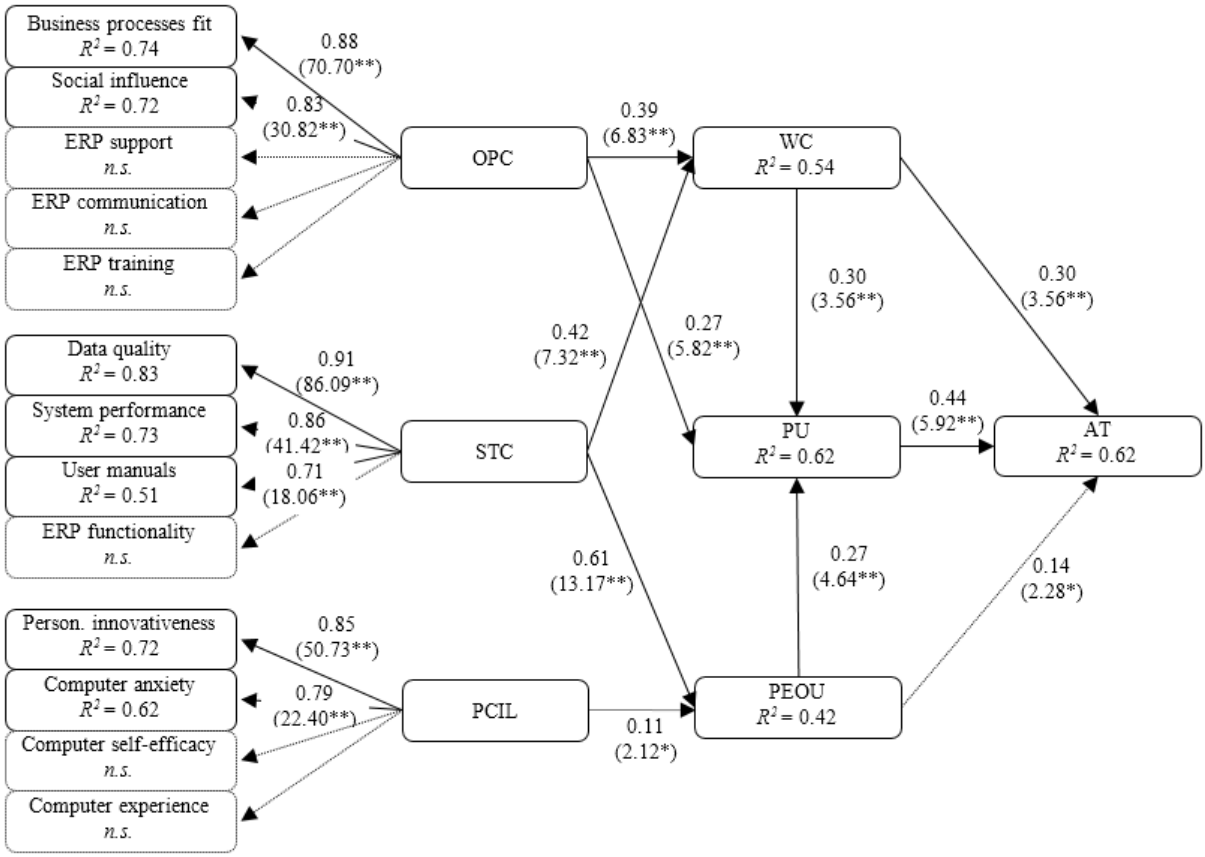

Fig. 2. Results of structural model analysis[a]

[a] Path significance: ** $p < 0.01$, * $p < 0.05$, n.s. = not significant (shapes are marked dotted).

Empirical research has shown support for original relationships of TAM in ERP settings in the maturity stage (for example, see [1],[4],[6],[21]). As shown in Fig. 2, our research confirms their results of the influence of perceived ERP ease of use (PEOU) and perceived ERP usefulness (PU) on attitude toward using ERP system (hypotheses H2 and H3) as well as influence of perceived ERP ease of use (PEOU) on perceived ERP usefulness (PU) (hypotheses H1).

Our research also confirms that work compatibility (WC) has a strong and significant positive effect on PU (hypothesis H4). Work compatibility (WC) also has a relatively weaker but significant positive effect on attitude towards ERP (hypothesis H5).

Fig. 2 also indicates that the loadings of the first-order factors on the second-order factors exceed 0.7, and second-order factors have significant positive effect on ERP usefulness and on ERP ease of use. PCIL has a weak but significant positive effect on ERP ease of use ($b = 0.11$, $p<0.05$); STC has a strong positive effect on perceived ERP ease of use ($b = 0.61$, $p<0.01$) and a strong positive effect on work compatibility ($b = 0.42$, $p<0.01$), and OPC has a strong positive effect on perceived ERP usefulness ($b = 0.45$, $p<0.01$) and on work compatibility ($b = 0.39$, $p<0.01$). These findings provide empirical support for hypotheses H6, H7, and H8.

5. Discussion

Perceptual construct work compatibility (WC) was presented as the degree to which an ERP user can do most of his or her tasks in an ERP solution. In our research, WC influences PU, which supports prior findings [39],[40]. Moreover, WC directly and indirectly (through PU) influences attitude toward ERP (AT); if ERP users can do most of their tasks in ERP solutions, they have a better attitude toward using ERP solutions.

Based on the analytical results, this study found that it is possible to observe more external factors through second-order factors. In the maturity stage, external factors' personal innovativeness and computer anxiety, through second-order factor personal characteristics and information literacy (PCIL), influence perceived ERP ease of use. Meanwhile, the external factors self-efficacy and computer experience were not significant.

In contrast to most IT implementation research, the fact that ERP implementation research is focused on one technology has enabled the effect of specific technological characteristics to be examined. We have not found any research which has examined the effects of system and technology characteristics (SCT) upon the ERP system's user acceptance. System and technological characteristics data quality, system performance, and user manuals have a strong impact on perceived ERP ease of use whereas ERP functionality was not statistical significant.

Furthermore, business process fit and organizational culture from organization-process characteristics (OPC) have a strong impact on perceived ERP usefulness. It is important for organizations to adopt the business processes of ERP solutions. Business process reengineering plays a particular crucial role in the early stages of implementation; it is moderately important in the acceptance stage but tends to be less important once the technology reaches the maturity stage [44]. However, our research shows that the business process fit is also important in the maturity stage. We cannot confirm Lee et al.'s conclusion [4] that, if an organization provides sufficient ERP support to organizational workers for their tasks, they are more likely to enjoy their work and improve their performance through the usage of the ERP system. Amoako-Gyampah and Salam discovered in their research that ERP user training and education had a significant impact not only during the implementation phases, but also in operation phases (and especially in the maturity phase), when training on a continuous basis is required to meet the changing needs of the business and enhance employee skills [18]. Our research shows that ERP users do not think that they need formal or informal training. ERP communication promotes users' trust of ERP systems, thereby leading to user acceptance and actual usage. ERP communication is viewed as having a high impact from initiation to system acceptance, as it helps minimize possible user resistance [44]; however, it was not found to be significant at the routine stage.

6. Conclusion

Although ERP solutions significantly reduce the time to complete business processes, help organizations share information [4], and lead organizations to offer a better work environment for their employees as by providing them a more efficient system with which to work, ERP solutions have been faced with high failure rates and an inability to realize promised benefits [5] in the maturity stage of the operational phase. Among the most important reasons mentioned problems seems to be that ERP users do not use these solutions properly. In our research we have analyzed influence of 13 external factors on increase of the degree of attitude of ERP users toward the ERP system. We extended already published research studies with different groups of external factors. Personal innovativeness, computer anxiety, self-efficacy, and computer experience are included in the conceptual factor personal characteristics and information literacy (PCIL). Data quality, system performance, user manuals, and ERP functionality are included in the conceptual factor system-technological characteristics (STC). Business processes fit, organizational culture, ERP support, ERP communication, and ERP training are included in the conceptual factor organizational-process characteristics (OPC). These three conceptual factors influence perceived ERP ease of use (PEOU), perceived ERP usefulness (PU) and work compatibility (WC), which further influence attitude towards using the ERP system (AT). Structural equation modeling (PLS approach) was employed to assess overall model fit to verify the causal relationships between factors. The aim of each organization that has implemented ERP solution should be that ERP users really use their ERP solution extensively. Through the researched model, we propose that organizations focused themselves more into the identified external factors that impact the second-order factors on ERP acceptance and usage. For more detail understanding of situation in each distinct organization, further research (including interviews with ERP users) should be conducted.

The research was based on an extended version of TAM through second-order factors to improve the explanation of ERP usage. The PLS approach for analysis of the model was used. Such research has the potential for explanation of the degree of ERP system usage. By confirming external factors, organizations should work on their organizational culture and business process fit, and conversely on their ERP system, to ensure better data quality, system performance, and user manuals for their users, thereby improving the degree of attitude towards an ERP system.

This study has certain limitations which may present the opportunity for further research. Since the respondents to the survey were limited to enterprises in one country, this study should be extended to other countries. Further research is needed to explore the importance of presented external factors in different phases of the ERP lifecycle as well as include additional external factors (e.g., top management support). Because ERP solutions are implemented by different methodologies and approaches, the importance of external factors by ERP solutions could also be explored. The impact of external factors on work compatibility as well as the impact of work compatibility on TAM should be researched.

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Review of corporate digital divide research: A decadal analysis (2003-2012)

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Abstract:
The digital divide (DD) refers to the gap between individuals, companies, regions and countries in accessing and using the information and communication technology (ICT). DD research is mainly oriented towards detection of differences in the ICT use among individuals. An important part of DD research refers to the differences in ICT adoption and use among corporations. The goal of this paper is to present a review of published papers on DD among corporations. Papers from the journals indexed in SSCI that investigate corporate DD were examined in order to compare the research on corporate DD in terms of: (1) geographical area, time frame of the study, sampled corporations; (2) phenomena used as the indicators/measure of DD, inequality type, ICT adoption cycle, determinants of DD; and (3) data collection approach, data sources, sample size and methodology used for investigation of DD determinants.

Keywords:
digital divide; corporations; ICT; review; adoption.

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1. Introduction

Developed and developing countries alike are trying to support the development of information societies in which information and communication technologies (ICT) support information sharing, improve the quality of life, and foster the economic development [1]. Differences in ICT use among countries are substantial since social and economic development of countries results in significantly unequal ICT use, both in terms of the number of users and in terms of use sophistication [2]. Individuals in developed and thus richer societies have better access to ICT and use ICT in a more advanced way compared to individuals in developing countries [3].

The above mentioned differences are often referred to as the digital divide (DD), the term that was first introduced in the 1990s when researchers wanted to explain the difference between having or not having, using or not using computers and the Internet [4]. There are many definitions of DD, but the term refers to the gap between individuals, companies, regions and countries in accessing and using ICT [1]. The notion of DD can be also used to explain socioeconomic differences arising from ICT use [5, 6], and demographic and economic characteristics of users [7].

Early research on DD was oriented towards the infrastructure, availability and affordability of computers and the Internet use [6, 8]. Present-day studies measure DD using indicators such as [1]: ICT sector development; ICT market development; ICT penetration and ICT use in households; ICT use in enterprises; ICT education development; and ICT government. Barzilai-Nahon [6] reports on a number of studies dealing with DD and prominent integrated indices for measuring DD, such as DIDIX (Digital Divide Index), and the Digital Access Index (made by the International Telecommunication Union).

DD research is mostly focused on individuals and countries and there are many empirical studies which investigate the existence of DD between countries and within a society [4, 9]. Wang et al. [10] found out that recent DD research focuses mostly on technological diffusion and different cultural practices. To our knowledge, attempts of reviewing articles about DD on the corporate level are rare. The goal of this paper is to assess the level of DD among corporations based on published research papers, according to: (1) geographical area, time frame of the study, sampled corporations; (2) phenomena used as the indicators/measure of DD, inequality type, ICT adoption cycle, determinants of DD; and (3) data collection approach, data sources, sample size and methodology used for investigation of DD determinants.

This paper consists of five sections including the introductory part. The literature review is presented in the next section. The research methodology is explained in the third part of the paper, including the literature-selection process and the analysis process. Results are presented in the fourth section. The discussion part explains our findings. Section six concludes the paper.

2. Literature review

During the last 50 years, technological development has been one of the main factors in shaping modern societies. The increase of competitiveness is supported by availability of effective telecommunications systems, access to the high-speed Internet, and development of mobile telecommunications [11]. ICT is one of the main drivers of changes and innovations in corporations [12], as well as the main driver of the economic development and employment [13, 14]. For example, research indicates that, in the European Union countries, the ICT contribution to Gross Domestic Product (GDP) growth and to the productivity increase amounts to 25% and 40% respectively [15].

ICT has a positive impact on productivity and economic success of corporations [9, 4, 16, 17] and ICT drives positive changes in corporations' structures [18]. Corporations which are not electronically interconnected lag behind. Small and medium enterprises get most benefits from using new technologies because that way they can easily connect with larger corporations and become a part of their business, as well as with other small enterprises which are geographically distant [19].

The above discussed differences in the level of ICT use are referred to as the digital divide (DD). The notion of DD can reveal inequalities across the global information society [8], which affects the economic growth and development of individual countries [20]. DD can be measured using a framework of questions to determine who is connected, with which user characteristics, how and to what [21]. A number of authors have examined the impact of demographic factors on ICT use: gender, income, educational level, age [22], employment [2], ethnicity [9], and urban or rural community as a place of living [23].

The results of the analysis made in 2008 confirm the existence of DD between the EU15 countries and the countries which were candidates in 2004 (Romania, Bulgaria and Turkey) [1]. The same research showed that some of the EU15 countries, e.g. Greece and Portugal had the same Information Society level as the countries which joined the European Union in 2004, e.g. Cyprus and Slovenia. DD has also become an important issue of the EU Digital Agenda for Europe, which aims to maximize the social and the economic impact of information and communication technology, especially in doing business. Specifically, one of the goals of the European Commission is to enable 50% of the population to buy online by 2015 and 33% of SMEs to establish an online shop by 2015 [24]. Such pressure arises from the fact that among the Financial Times Global 500 ICT companies only 10% are European.

Certain percentage of research focuses on the first and the second order of DD [25]. Research on the first order DD is dealing with population groups as characterized by access to ICT and the second order DD refers to inequality in the ability to use ICT among users who have access. Both the first and the second order of DD can be analyzed at three levels: an individual level, an organizational level and the global level. The individual level refers to people who are ready to integrate ICT into their everyday lives and those who lag behind in accessing and using new technologies. The organizational level refers to organizations which gain competitive advantage by implementing ICT into their core business processes and organizations which are left behind because they are not ready to use all of the benefits of ICT. The global level refers to countries which adapt their policies to promote ICT and which invest in it, and countries which still do not realize the positive impact of ICT, so they are left behind.

3. Methodology

In this section we describe data which we have used and how we have analyzed it, keeping in view the goal of the study. Therefore, we present the literature-selection process and the analysis process of the journal articles incorporated in the research. Fig. 1 outlines the literature-selection and the analysis process.

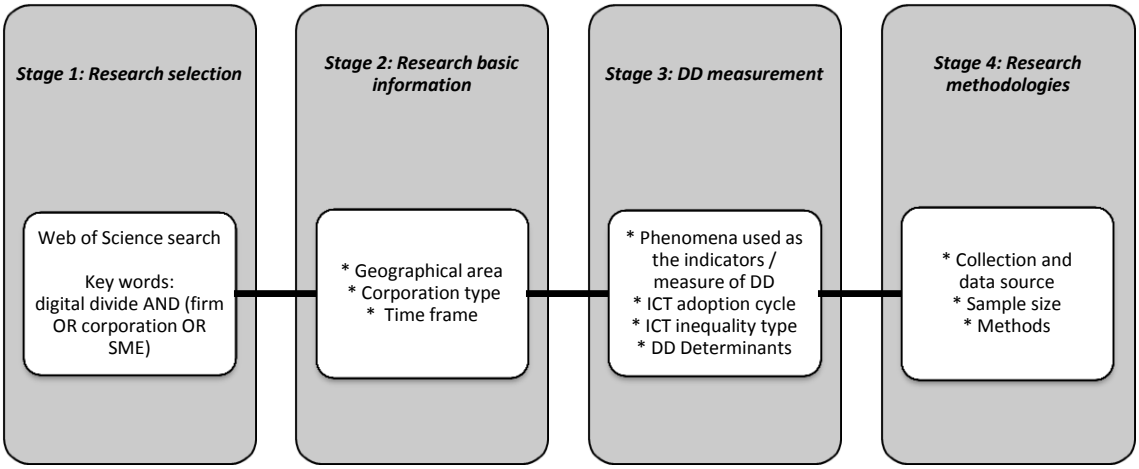

Fig. 1. Literature-selection and analysis process

3.1 Stage 1: Literature selection

Literature selection was performed in several stages. Web of Science was searched using the phrase: "digital divide" AND (firm OR corporation). The period from 2003 to 2012 was set as the time frame for the research. Only articles published in peer-reviewed journals were included in the review. The search also revealed articles on DD at the individual, the household, and the national level. In order to eliminate such articles, additional filtering was applied based on the full-text investigation. This approach resulted in 24 articles, published in a variety of journals, such as: European Planning Studies; Government Information Quarterly; International Small Business Journal; Information Economics and Policy; Information Systems Research; International Journal of Production Economics; International Journal of Information Technology and Management; Internet Research; Information Technology and People; Information Society; Journal of the Association for the Information Systems; Journal of Theoretical and Applied Electronic Commerce Research; Management Science; Journal of Productivity Analysis; Management Research Review; and Online Information Review.

3.2 Stages 2-4: Analysis process

In accordance with the goal of the paper to investigate the levels of DD among corporations, a rigorous analysis process has been applied. In order to analyze papers dealing with DD on the organizational level, we have applied a research framework based on the following characteristics - research basic information; DD measurement; and research methodologies:

- *Research basic information* refers to: geographical area (countries in which the research has been conducted), firm type (according to the size and the industry) and time frame (years when the research was conducted);
- *DD measurement* refers to: phenomenon that was used as a proxy for corporate DD, ICT adoption cycle (ICT Use, ICT Access and ICT Innovations), inequality type (First and Second Order Digital Divide), and determinants of DD (independent variables examined as important factors of DD);
- *Research methodologies* refer to: data collection (e.g. survey, transactions), data sources (primary and secondary data), sample size, and methods (quantitative and qualitative).

All of the papers were examined by two independent researchers, and coded according to the above describe methodology. In only a few cases, differences in coding were found, and in such situations, the differences were discussed by both researchers in order to agree on a common classification. Using this approach, we were able to overcome the limitations of earlier research on DD, i.e. lack of theory, conceptual definition, interdisciplinary approach, qualitative and longitudinal research [8].

4. Results

Table 1 presents the data on geographical area, firm type and time frame. Different types of corporations are included in the studies: small and medium enterprises, small exporting enterprises, manufacturing corporations, small and medium enterprises which are oriented towards tourism, corporations in the insurance industry, corporations in the financial and services sectors and agribusiness.

The majority of studies was conducted after 2000, and the greatest proportion of research was conducted in 2002. Most of the studies were conducted in developed countries such as the USA, Italy, France, New Zealand, and Canada. There were only three international studies (EU, EU-25, global). Researchers mainly focused on specific groups of corporations such as SMEs, manufacturing corporations, tourism corporations, or rural enterprises. Only one research study [43] selected corporations based on the ethnicity of the owner (Hispanic-owned enterprises). The research time frame of most studies was only one year, with only a few studies covering longer periods, which indicates the cross-sectional nature of the studies.

Table 1. Geographical area, type of corporations and time frame

Study	Country	Corporations	Year of study
Arbore et al. [26]	Italy	SME	2003
Arora et al. [27]	USA	>100 employees	1998-2000
Atzeni et al. [28]	Italy	Manufacturing corporations; 11–500 employees; >500 employees	2003
Bapna et al. [29]	Global	Corporations	2005
Billon et al. [30]	EU-25 countries	Corporations	2006
Chong et al. [31]	Malaysia	Manufacturing corporations	2008
El-Gohary [32]	Egypt	Tourism SMEs	N/A
Forman et al. [33]	USA	Corporations in insurance industry	1996, 1998, 2000, and 2002
Forman [34]	USA	Financial and services corporations	1996-1998
Galliano et al. [35]	France	Agribusiness >20 employees	2002
Galliano et al. [36]	France	Manufacturing corporations	2002
Galliano et al. [37]	France	Manufacturing corporations that use Internet	2002
Galve-Górriz et al. [38]	Spain	Manufacturing corporations	2002
Gargallo-Castel et al. [39]	Spain	Manufacturing corporations	2002
Grimes et al. [40]	New Zealand	Corporations	2006
Hinson et al. [41]	Ghana	Exporting SMEs	2005
Ifinedo [42]	Canada	SMEs	2007-2008
Labrianidis et al. [43]	Greece, Portugal, Germany, Poland, UK	Rural innovative enterprises	2004
Lee et al. [44]	Korea	Corporations	2004
Middleton et al. [45]	USA	Hispanic-owned SMEs	N/A
Middleton et al. [46]	USA	SMEs	N/A
Nurmilaakso [47]	EU	Corporations	2003-2005
Pighin et al. [48]	Italy	Corporations	N/A
Rodriguez-Ardura et al. [49]	Spain	Corporations	1996-2005

Table 2 presents the data on measurement, impact and order of DD, the ICT adoption cycle and determinants of DD. A number of indicators can be used to measure DD. In the examined studies, DD was measured using the following indicators: broadband adoption; Internet applications; electronic payment systems (EPS); website adoption; adoption of e-Collaboration tools in the supply chain; investments in ICT; e-Government service; and Wi-Fi. In most of the studies, the inequality type refers to the second order, i.e. the differences in the ability to use the information and communication technology among users who have access. Among the examined research, 14 papers investigate the Inequality type of the Second Order, 10 papers of the First Order, and one paper both studies. According to the ICT adoption cycle, 6 papers investigate ICT Access, 16 papers investigate ICT Use, but only 2 papers investigate ICT Innovation.

Determinants of DD are different for each study included in our analysis, but can be classified into five groups. The first group refers to external determinants which include: geographical area; population density; public assistance; and the level of economic development. The second group refers to firm specific factors which include: size; industry type; group; foreign owner; and the level of competition. The third group refers to business-specific factors which include: trust; product complexity and volume; vertical integration; suppliers; and customers push. The fourth group refers to ICT investments which foster implementation of new technologies: investments in servers; e-business investments; ERP use; CRM use; and technological readiness. The fifth group stems from human resources factors such as: trained workers; wages; higher employee qualification; knowledge management; and participative management.

Table 2. Measurement, impact and order of DD, ICT adoption cycle and determinants of DD

Study	Phenomena used as the indicators/measure of DD	Inequality type / ICT adoption cycle	Determinants of DD
Arbore et al. [26]	Broadband adoption	First Order / ICT Access	Size, geographical area, and ICT strategies
Arora et al. [27]	Internet / LAN	Second Order / ICT Use	Internet and LAN adoption are complimentary
Atzeni et al. [28]	Adoption of ICT	First Order / ICT Use	Public assistance
Bapna et al. [29]	Electronic payment (EPS)	First Order / ICT Use	Firm size, region and industry type
Billon et al. [30]	Website adoption	Second Order / ICT Use	GDP per capita, population density, sectoral composition and education
Chong et al. [31]	E-Collaboration in supply	Second Order/ ICT Access	Trust, product complexity and product volume
El-Gohary [32]	Electronic marketing	Second Order/ICT Innovation	Both external and internal factors
Forman et al. [33]	ICT for distribution & communications	First Order/ ICT Access	Vertical integration enforces Internet applications
Forman [34]	Internet access	First Order/ ICT Access	Prior investments in client/server networks
Galliano et al. [35]	Electronic traceability systems (ETS)	Second Order / ICT Use	Firm size, group, e-business, contracts with suppliers/customers, industrialization
Galliano et al. [36]	Internet adoption; intensity of Internet use	First Order / Second order / ICT Use	Spatial disparities affect intensity of Internet use
Galliano et al. [37]	Intensity of use of ICT	First Order / ICT Use	Geographical dispersion of the firm, belonging to a group, and the competition
Galve-Górriz et al. [38]	Investments in ICT	First Order / ICT Use	Educated and trained workers, specific training and higher wages
Gargallo-Castel et al. [39]	Adoption of ICT	Second order/ ICT Access	Higher employee qualifications, related technology and firm size
Grimes et al. [40]	Internet access	Second order / ICT Use	Firm size, management, foreign owner, knowledge intensity, R&D, industry, firm age
Hinson et al. [41]	E-business	Second Order / ICT Use	Perception of the strategic value of e-business
Ifinedo [42]	Internet and e-business	Second Order / ICT Use	Relative advantage, management, competitors
Labrianidis et al. [43]	Use of ICT	First Order/ ICT Access & ICT Use	Geographical position of the firm, industry, firm size, network intensity
Lee et al. [44]	e-Government service	Second Order / ICT Use	Timeliness, responsiveness, service quality
Middleton et al. [45]	ICT adoption and use	Second Order / ICT Use	Non-Hispanic ethnicity
Middleton et al. [46]	WiFi	Second Order / ICT Use	Non-Hispanic ethnicity and age
Nurmilaakso [47]	E-business	Second Order / ICT Use	Number of subsidies, use of ERP, SCM and CRM, exchanging standardized data
Pighin et al. [48]	ICT use	Second Order / ICT Innovation	Knowledge, training, participation
Rodriguez-Ardura et al. [49]	E-commerce	Second Order / ICT Use	Consumer and competitive pressure, technological readiness, innovations

Table 3 presents data collection, data sources, the sample size and methods. The data were mostly collected through surveys. Exceptions are two studies in which data were collected by in-depth interviews and from transactions recorded in the database. Different data sources were used. Most authors collected data, but some authors also used data collected by institutions, e.g. 2002 ICT Survey/French National Institutes of Statistics, Spanish Survey on Business Strategies and Harte Hanks CI Technology Database.

The sample size varied from 100 to 30,000. Methods used are as follows: regression (multiple regression, logit model and binomial-logistic regression); multivariate (Mann-Whitney, Wilcoxon tests); and machine learning models (structural equations modelling, continuous-time survival model, discrete choice model and tree-based technique).

Table 3. Data collection, data source, sample size and methods

Study	Data collection	Data source	Sample size	Methods
Arbore et al. [26]	Survey	Author	920	Tree-based technique, binomial-logistic regression
Arora et al. [27]	Survey	Harte Hanks CI Technology Data	19860	Discrete-choice model
Atzeni et al. [28]	Survey	Survey of Manufacturing Corporations (SMF) carried out by Area Study of Capitalia Bank	2290	Matching estimator
Bapna et al. [29]	Transactions	The billing data from one of the top Fortune 100 companies	4,922 transactions	Finite mixture model
Billon et al. [30]	Survey	ESPON Project Indicators	N/A	Econometric methods
Chong et al. [31]	Survey	Authors	109	Correlation and multiple regression analysis
El-Gohary [32]	Survey	Authors	163	Structural equations modelling
Forman et al. [33]	Survey	Harte Hanks CI Technology Database	100	Continuous-time survival model
Forman [34]	Survey	Harte Hanks CI Technology Database	6156	Discrete choice model
Galliano et al. [35]	Survey	2002 ICT Survey / French National Institutes of Statistics	2821	Probit model
Galliano et al. [36]	Survey	2002 ICT Survey / French National Institutes of Statistics	5200	Probit model
Galliano et al. [37]	Survey	2002 ICT Survey / French National Institutes of Statistics	4434	
Galve-Górriz et al. [38]	Survey	Spanish Survey on Business Strategies	1296	Mann-Whitney, Wilcoxon tests
Gargallo-Castel et al. [39]	Survey	Spanish Survey on Business Strategies	1685	Probit model
Grimes et al. [40]	Survey	Statistics New Zealand's Business Operations Survey 2006 (BOS06)	6051	Propensity score matching
Hinson et al. [41]	Survey, in-depth interviews	Author	60	Descriptive, ANOVA
Ifinedo [42]	Survey	Author	214	Partial Least Squares
Labrianidis et al. [43]	Survey	Future of Europe's Rural Peripheries	996	Logit model
Lee et al. [44]	Survey	Korean e-Government research project	836	Logit model
Middleton et al. [45]	Survey	Author	158	Principal components analyses
Middleton et al. [46]	Survey	Author	158	Principal components analyses
Nurmilaakso [47]	Survey	e-Business W@tch	4570	Linear regression model
Pighin et al. [48]	Survey	Author	58	Descriptive statistics
Rodriguez-Ardura et al. [49]	Survey	Survey on the Use of ICT and E-commerce in Spanish Companies	28880	Multiple regression

5. Discussion

5.1 Research basic information: time, place and corporation type

Geographical distribution of the examined research is represented in Fig. 2, and it is evident that most of the research has been conducted in European countries, followed by the North American countries (the USA and Canada). European countries are the most researched, including Italy, France, Spain, Greece, Portugal, Germany, Poland and the UK. Other regions and continents are represented by only one country in the research examined in our analysis.

Although we have focused only on the sample of journal articles, we believe that the conclusion reached based on a few instances of research in developing countries is valid. Surprisingly, articles that use the term DD and are focused on different levels of ICT use in corporations mostly deal with developed countries, and less with developing countries, while the conducted research indicates that corporate DD is present in developing countries more than in developed countries and it thus further fosters their further lagging behind developed countries.

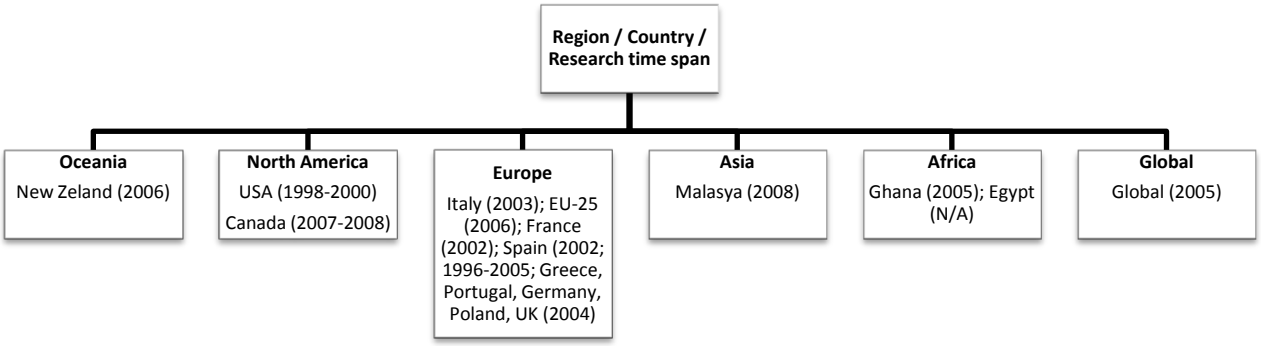

Fig. 2. Geographical distribution of corporate DD research

Fig. 3 represents different types of corporations examined in researched articles. Authors of the papers examined corporations of different sizes, including both SMEs, and large corporations with more than 100 or even 500 employees. According to the industry types, corporations included in the analysis were: manufacturing, finance, insurance, service-oriented, tourism and agricultural corporations. Several researchers have focused their research on specific types of corporations, such as rural, export SMEs, and corporations owned by the Hispanic owner. However, the largest number of research was conducted on the sample of corporations of different sizes and of different industries.

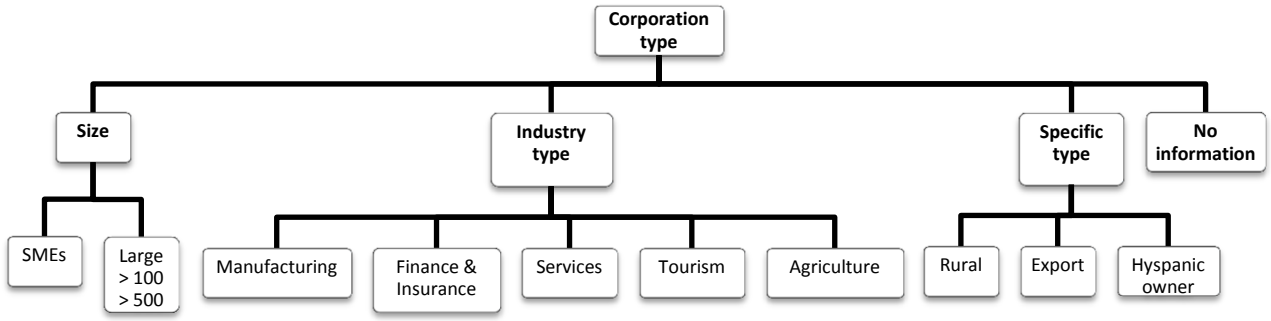

Fig. 3. Corporations examined by the corporate DD research

5.2 DD Measurement: ICT inequality types and adoption cycle, DD determinants

The phenomena used as measures of DD could be divided into three groups. The first group includes the general ICT use, such as the adoption of ICT [28], intensity of use of ICT [35], and investments in ICT [38]. Within that group, most researchers found the First Order DD, and focused on ICT use. The second group of measures includes the adoption of the Internet [34, 36] and broadband adoption [26]. Researchers in this group predominantly investigated the First Order DD and ICT Use. The third group investigated ICT use for specific business purposes, e.g. e-collaboration [31], electronic marketing [32], and e-Government services [44]. The authors proved that the Internet and e-business activities improve business processes in several ways: (1) automated transactions enhance the efficacy; (2) reducing the number of intermediaries' results in an increased economic growth; (3) demand and supply processes are connected; and (4) production results improved [42].

Fig. 4 presents the timeline distribution of the research according to the inequality type, revealing that research on the first order corporate DD was examined mainly in the surveys conducted from 1996 to 2003. After that period, research is mainly focused on the second order corporate DD. Therefore, we conclude that research on the mere presence of ICT will be less and less conducted, since the ICT infrastructure becomes developed in most of the countries of the world. On the other hand, research on inequality in the ability to use ICT among users will be the focus of the future research, especially in developing countries.

Study	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	N/A
Arbore et al. [26]	FO		FO		FO		FO							
Arora et al. [27]	FO		FO											
Atzeni et al. [28]	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO				
Bapna et al. [29]			SO	SO	SO									
Billon et al. [30]							SO							
Chong et al. [31]							FO							
El-Gohary [32]							FO							
Forman et al. [33]							FO							
Forman [34]							SO							
Galliano et al. [35]								FO						
Galliano et al. [36]								FO						
Galliano et al. [37]								SO	SO	SO				
Galve-Górriz et al. [38]												SO	SO	
Gargallo-Castel et al. [39]									FO					
Grimes et al. [40]									SO					
Hinson et al. [41]										FO				
Ifinedo [42]										SO				
Labrianidis et al. [43]											SO			
Lee et al. [44]											SO			
Middleton et al. [45]													SO	
Middleton et al. [46]														SO
Nurmilaakso [47]														SO
Pighin et al. [48]														SO
Rodriguez-Ardura et al. [49]														SO

Fig. 4. Timeline of the research according to inequality type

Notes: FO – First order digital divide, SO – Second order digital divide

Fig. 5 represents the timeline of the research according to the ICT adoption cycle: ICT Access, ICT Use and ICT-based Innovations. Research on ICT Access was conducted mainly from 1996 to 2002. Most research focused on the ICT Use, mainly based on the technology adoption model, and only two papers examine ICT-based innovations. Our conclusion is that future research should be dedicated to the ICT-based innovations more than to the ICT Use.

Study	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	N/A
Arbore et al. [26]	ACC		ACC				ACC							
Arora et al. [27]	ACC		ACC											
Atzeni et al. [28]	USE	USE	USE	USE	USE	USE	USE	USE	USE	USE				
Bapna et al. [29]			USE	USE	USE									
Billon et al. [30]							USE							
Chong et al. [31]							USE							
El-Gohary [32]							USE							
Forman et al. [33]							USE							
Forman [34]							ACC							
Galliano et al. [35]								ACC						
Galliano et al. [36]								USE						
Galliano et al. [37]								USE	USE	USE				
Galve-Górriz et al. [38]												USE	USE	
Gargallo-Castel et al. [39]									ACC& USE					
Grimes et al. [40]									USE					
Hinson et al. [41]										USE				
Ifinedo [42]										USE				
Labrianidis et al. [43]											USE			
Lee et al. [44]											USE			
Middleton et al. [45]													ACC	
Middleton et al. [46]														INNO
Nurmilaakso [47]														USE
Pighin et al. [48]														USE
Rodriguez-Ardura et al. [49]														INNO

Fig. 5 Timeline of the research according to ICT adoption cycle

Notes: ACC- ICT Access, USE-ICT Use, INNO – ICT Innovations

Determinants of the corporate DD could be divided into external and internal factors. External factors include corporations' characteristics such as size, geographical area, region and industry. Internal factors involve specific actions of the firm management, e.g. vertical integration, education of employees, and use of other technologies. In addition, when examining the timeline of the research according to the determinants of the corporate DD, more research has been conducted on internal factors that increase adoption and ICT use, especially in accordance with the corporate strategy. Many national and international corporations and governments have developed strategies, initiatives and programs in order to improve and enhance ICT use [50]. Our research, however, revealed that the ICT strategy was found to be a determinant of the DD level in only one case [26].

The general conclusion of our research is similar to the conclusion of Forman and Goldfarb [19], i.e. that the adoption of ICT in corporations depends upon several factors: the location size; ICT complexity; the importance of the technology in business processes; the strategy of the corporation; and demographic characteristics of the employees (age and educational level).

5.3 Research methodologies: Sample, Source, Methods

In most cases the data were collected by questionnaire surveys on samples of varying sizes, ranging from 58 corporations in one in-depth study [48] to 28,880 corporations that participated in one large national study [49]. Secondary surveys were used as a data source in approximately half of the papers, while the rest used the data collected by authors. The used research methods included linear and multivariate regression, structural equation modeling, and machine learning models such as the continuous-time survival model. Most of the research was cross-sectional, based on the survey conducted by the author. Panel research is more difficult to conduct in the corporate research area, due to

the unpredictable "lifetime" of corporations, but it should be attempted since it would shed some light in the area of ICT adoption and use over time, especially in the field of ICT-based innovations.

6. Conclusion

The rapid growth of information and communication technology plays an important role in everyday life, politics, the economy and the society [51]. Since access to and the use of ICT have positive effects on global interaction, commerce, economic growth and social welfare, DD shrinkage is of the highest importance [25, 52, 53]. The main goal of the paper was to review papers dealing with the level of the corporate DD. In order to accomplish that goal, we examined articles retrieved from Web of Science. However, when considering the results of our research one should be aware that only Web of Science database was used as the source of papers dealing with the corporate DD. Furthermore, a large number of papers reported on the determinants of ICT adoption in corporations, but did not use the term "digital divide" to refer to the phenomenon. Such papers were not included in the sample, and only a limited number of articles were examined in depth.

Our research revealed that most of the papers on corporate DD investigate the first order corporate DD and ICT use in developed countries, using a large number of phenomena as a proxy for corporate DD, ranging from the general ICT use, the Internet use and the specific ICT use such as e-business. Most of the research revealed that internal factors in corporations are crucial for adopting and using ICT in order to increase business performance and competitiveness. However, in most of the cases, research has been conducted based on the cross-sectional survey carried out by the author.

Future research should focus on ICT access and use in developing countries and especially on the ICT-based innovations. We should see more research conducted by using secondary data such as transactional data or national data, since it allows larger samples, and a broader scope of corporations to be investigated. Panel survey should also be considered as an important source of investigation of development of ICT use. Further studies should also take into account qualitative studies, which could provide additional information on internal determinants of DD in corporations, especially in SMEs. Future research in the area of DD in corporations should also be oriented towards active policies for the elimination of the DD gap. Such policies could be undertaken by corporations themselves and/or by governments and even the European Commission, which would consequently broaden the scope of future research.

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