Enterprise Architecture Model: an approach proposition

A case study of information systems in the hospitality industry

Paula Serdeira Azevedo
Carlos Azevedo
Mário Romão

Abstract— **This paper discusses the role of enterprise architecture representation, in the context of ERP (Enterprise Resource Planning) information systems, as an instrument for an organization to reflect on itself and develop its business strategies and respective alignment with Information Systems.**

The paper proposes a representation model of enterprise architecture, as a tool for recommending good practices, and it emerges from a case study undertaken in the context of and investigation on advantages and limitations of ERP systems in the hospitality industry.

The proposed approach is also inspired on other academic or market propositions suitable for the objectives of the investigation. It consists on a set of items representing the steps that must be taken by top managers and IS managers.

Keywords—**Enterprise Architecture; Information Systems; Hospitality and Tourism.**

I. Introduction

Organizations face a challenging and changing environment nowadays, and this imposes high levels of competitiveness in the global market, forcing continuous change. The ability to change depends on the knowledge the organization has about itself, allowing for design and plan the inevitable changes.

Enterprise architecture is currently the best basis for the organization to describe its business strategies and respective development through IS/IT. A formal model of the enterprise architecture not only shows the current status but also the way its evolution is foreseen. It must display the more affected areas needing change and act also as a guide for the transition period. It is vital to understand the impact of continuous change on users involved in processes as well as on several operational IS . [*1*].

Paula Serdeira Azevedo
Universidade do Algarve
Portugal
pscorreia@ualg.pt

Carlos Azevedo
Universidade do Algarve
Portugal
cmazevedo@ualg.pt

Mário Romão
ISCTE-IUL, Instituto
Universitário de Lisboa
Portugal
mario.romao@iscte.pt

Given the importance of representation tools, together with the need to choose which framework better adapts to the needs and reality of each organization, this investigation established the goal of proposing an approach to Enterprise Architecture Model.

It has the purpose of being a reference for good practices when implementing and integrating systems and applications for the hospitality industry.

II. Methodology

With the purpose of identifying major critical success factors when implementing ERP systems, as well as factors that may obstruct organizations from being competitive, a case study was carried out based on data gathered on an important economic Portuguese group. The study also intended to understand how the hospitality industry can solve the problem of the disintegration of information of the various implemented business applications. The research did not seek to confirm or refute hypotheses or the quantitative measurement of the influence of variables in a particular phenomenon. Instead, it attempted to answer proposed questions, interpreting, through the systematic analysis of the collected data, ratings, perceptions, needs and limitations of IS/IT submitted by the people involved in the study.

Therefore, an inductive logic followed, with emphasis on the analysis of qualitative data and using the case study method. Several authors support the strategy of the qualitative approach, particularly in the study of problems related to organizations and technology [*2*] [*3*] [*4*] [*5*]. Although the dominant approach in research processes in the area of IS has been, until some time ago, the quantitative analysis, the research using the case study method, with qualitative data collection, has become increasingly accepted in the area of IS. This appears to stem from a growing recognition of the potential to help researchers understand the interpretations and meanings that govern activities of organizational stakeholders, as well as how technology is faced and used.

The research presented followed an interpretative approach. In view of the issues to investigate, an approach to understanding and interpreting facts was adopted, by the insertion of researchers in the organizational context of hotel units. This interpretative option permits that a group of people, including managers, directors of IS, or users, in an organizational context, can express, conceptualize and assess the objectives defined by the research. The research method

International Journal of Advances in Computer Science and its Applications – IJCSIA
Volume 4 : Issue 1   *[ISSN 2250 – 3765]*

Publication Date : 09 January 2014

adopted combines several techniques, such as semi-structured interviews with the Chairman of the Board of Directors of the hotel group, the director of IS/IT's department of the group, as well as the heads of logistics, human resources and financial areas of the IS/IT's department of the hotel group, in order to find inefficiencies and inconsistencies in the information used and facilitate the analysis of the processes involved. Interviews with key elements of the organization are a way of ensuring an experienced vision of who is inserted in it and could induce a faster knowledge of what is analyzed. A questionnaire survey for key users was also used. Respondents are users of IS, heads of each department in each hotel unit, with the purpose of understanding the users' satisfaction in relation to the IS/IT implemented in the group, serving, at the same time, the purpose of confirming data consistency. The process was completed through documentary analysis of data collected in the hotel units and by direct observation of the use of installed applications. With the objective of analyzing the systems available and its application in the hospitality industry, solutions and proposals put forward by the leading supplier of integrated applications management were also examined. As a way to collect opinions and suggestions on the information collected, as well as the analysis of the same, a panel of experts in the field of IS/IT was consulted.

III. Enterprise Architecture: literature review

Enterprise Architecture is about representing multiple aspects of the organization, building high level logic design, which, besides specific constraints, allow interface definition and control, as well as integration of all components involved in the reality under analysis [*6*].

The major advantage it brings is a set of mechanisms that guarantee strategic alignment between IS and strategic goals established by the organization. There is no efficient strategic planning without designing enterprise architecture [*7*].

Enterprise architecture supports strategy, analysis and planning, providing a view of current state of business and IS/IT, as well as its foreseen evolution [*8*].

There are several concepts or organizational architectures in literature, such as IS architecture, information architecture, software architectures, among others. Establish a clear border among these concepts is not an easy task, as there is no consensus about its definitions and usage. This problem might be explained by the complexity embedded in the content of the concepts in presence. Translations using the same word for different concepts increase the complexity.

So, several definitions coexist, depending on the investigators approaching the subject:

For Spewak and Hill, enterprise architecture is the process of defining frameworks for information to support business and its implementation [*1*]. According to Zachman, enterprise architecture assumes vital importance concerning constant need to evolve and innovate, as it includes a set of relevant descriptions of the organization, providing flexibility and

enabling capacity for sudden changes and instability of business environment[*9*].

According to ANSI/IEEE 1471-200 standard norm, enterprise architecture is a set of principles guiding design, selection, construction, implementation, installation, maintenance and management of the informational infrastructure of an organization[*10*].

According to Kozina, enterprise architecture is a coherent set of principles, methods and models displaying multiple aspects of an organization. These elements and generally grouped into five different layers : business architecture, data architecture, application aarchitecture and infrastructure architecture) [*11*]. This is shown in Fig. 1.
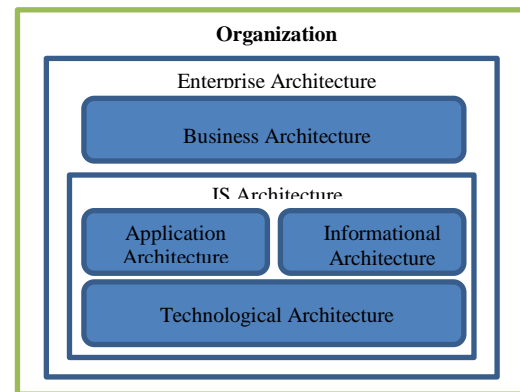

Figure 1 – Enterprise Architecture
Source: adapted from Kozina (2006); Zachman (1978)

According to Hoogervorst, business architecture defines and describes business processes needed to strategy implementation[*12*]. It includes models and processes that make possible to characterize, define and implement the business [*13*].

Zachman defines IS architecture as a set of representations necessary to describe a system (or a set of systems) with the objective of its building, maintenance or evolution. It displays the organization through schemes in a group of conceptual models, built aiming at a coherent and clear image of the organization; integrates multiple business aspects (goals, views and strategies), operational aspects (organizational structure, processes and information), applicational aspects (applications, systems and databases), and it includes technological infrastructure (operating systems, computers and networks [*6*].

IS architecture has the objective of representing those components, its relationship, principles and directives [*10*], as well as to support business [*14*], identify critical information[*15*], its evolution and the introduction of new technologies, under a strategic view of business plans [*1*] [*16*].

According to Spewak and Hill, there are more than one IS architecture, reflecting different views about IS and presenting a set of different perspectives [*1*]:

- Informational (or Data) Architecture – represents several types of data supporting the business;

International Journal of Advances in Computer Science and its Applications – IJCSIA
Volume 4 : Issue 1   ***[ISSN 2250 – 3765]***

Publication Date : 09 January 2014

- Applicational Architectures – defines applications needed to manage data and business support;

- Technological Architectures – represents major technology used in the implementation of applications and infrastructure supplying an environment for IS to run.

Lately several authors proposed frameworks to describe enterprise architecture. Among the tools proposed we can find methods and modelling languages, as well as application systems.

IV. Case study: representing the enterprise architecture of the hotel group studied

According to the objectives of the investigation and the necessary decision on how to represent the enterprise architecture of the corporate group studied, the framework EAP (Enterprise Architecture Planning) was chosen, as adequate to SI business modelling. With this framework the organizational structure was documented and at the same time the processes were identified and described through matrix techniques.

Given the stated objectives of the investigation, the following aspects of the studied group were represented:

- Value chain;

- Organizational structure;

- Processes;

- Current applications;

- Technological infrastructure.

After defining the enterprise architecture, including analysis on the advantages, limitations and level of process coverage of the ERP systems in presence, a representation model was proposed, established as a reference to support management and decision making about application implementation and integration.

The proposed model is also inspired in other academic and market proposals suitable for the objectives of the investigation. It consists on a set of items representing the steps that must be taken by top managers and IS managers, namely:

(a) Business modelling, having EAP framework as the basis;

(b) Application portfolio management based on J. Ward approach and development of this methodology [17] and [18];

(c) A methodology for vendor and services selection, merging criteria proposed by several authors. The basic software functionalities for the hospitality industry, according to field data collected during the investigation;

(d) Management of implementation projects, referring a set of best practices mentioned by some authors, and that should be taken in consideration on any IS/IT project.

The model also introduces some practical techniques found in ERP vendors, such as SAP Best Practices, a set that includes software oriented to application prototyping under ERP SAP system. From the same vendor, SAP Blueprint was consulted, a base structure to develop ERP SAP projects.
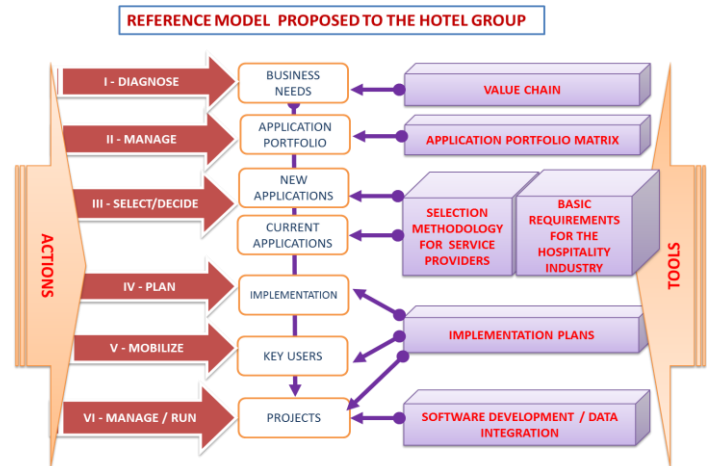

Fig. 2 – Proposed EA Model

Each of the blocks the model proposes (I - Diagnose; II - Manage; III - Select/Decide; IV - Plan; V - Mobilize; VI – Manage/Run) is detailed next:

I – **Diagnose** business needs

One of the required and more important actions for a successful implementation is the analysis and reengineering of business processes. This effort forces a critical look into the organization´s processes [24]. Business modifications normally correspond to new processes, either business (adding value) or support processes. To know and update the value chain is, for this reason, the starting point.

II – **Manage** the application portfolio

It is important to ensure a quick connection between the surge of new business needs deriving from internal or external needs and the application architecture, timely updating the application portfolio matrix. One of the matrix´s purposes is to identify applications with different levels of criticality and thus manage those applications accordingly.

Another purpose, and also what makes the matrix dynamic, is the evolution on the applications positioning. This evolution results from the analysis of critical success factors and competitive advantages of the organization, crucial tools to determine potential applications for future IS[17].

III – **Select/Decide** on possible transition to new applications or updating existing ones

Whatever might be the evolution of the application portfolio and the choice between update/maintain or replace with new ones, the organization must consider two working tools: (a) a methodology for vendor selection; (b) the required functionalities for the hospitality industry.

(a) Methodology for software vendor and services selection

When new business needs are detected, users and IT departments face the decision of replacing existing applications, either by build/buy new solutions, or to maintain/update those already in place.

(b) Required functionalities for the hospitality industry

In order to have a clear view of what should be present in application offer for this industry, the value chain processes were mapped. They split between business processes (those adding value to the organization) and support processes.
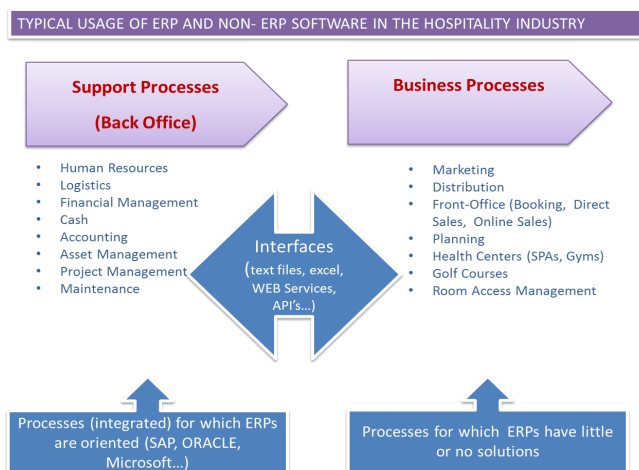
Please refer to Fig.3.

Figure 3 – Mapping applications for the hospitality industry

It can be observed that ERP software offer, with high level of integration, is almost exclusively oriented to support processes, those that are independent of nuclear activities of the organization. In this case the hospitality industry normally adopts generic applications, common to all kind of industries.

ERP systems offered by the market, covering typical business processes of this industry, do not provide levels of integration as ERP systems covering back office processes. Offer is limited to the so called Property Management Systems (PMS), mostly oriented to front office.

PMS are software solutions for the hospitality industry, providing some business processes as well as interfaces for back office (Finance, Purchase Orders, etc.), including centralized and hierarchized data (customers, logistics, etc.), allowing for local as well as global data management.

IV – **Plan** implementation

In order to obtain the expected benefits, it is mandatory to evaluate objectives, constraints, limitations, deadlines for implementation phases and conclusion of the project, responsibilities and level of authority of project managers[*25*].

As pointed out by some authors, the project must have all the conditions provided for any other strategic objective, such as top level commitment, allocated teams, time, budget and risk analysis[*26*].

V- **Mobilize** key users

When implementing an IS any organization suffers important changes, so the project must have accurate goals, having in mind eventual reconfiguration of roles and responsibilities. Attitude and behaviour of users may compromise the success of any implementation project.

The role of a sponsor, or champion as it also known, is of recognised importance. So this key role must be allocated to someone duly empowered for the job (or at least with capacity to influence decision making).

Training, namely through internal trainers, is a guarantee of efficient application software usage, specially when changes occur at process level.

Internal trainers are one of the best resources for the evaluation of changes impact and must be involved since early stages of the project. They are the best source of validation of the applicability of a given application feature to the process it intends to cover.

VI – **Manage/Execute** application development and data integration

In the case studied, although installed applications have been acquired to software vendors, the need for further developments by the IS/IT internal team still exist. These developments are of two types: (a) application development or (b) interface development in order to integrate application data.

(a) In the first case, as in almost any other organization, we observe the backlog phenomena, what can be defined as a set of requirements for new applications or amendments to others, waiting on a spool list for their opportunity to come into production. IS/IT teams are more and more confronted with less resources to use and lower budgets. The problem of priorities is constantly posed, as a lot of time is spent in maintaining existing application software.

As a paradox, the development of new and innovative application software capable of bring competitive advantages is harder, however even more necessary. This paradox has had two types of trends along the way:

(1) To enable user with technical capacity to build themselves the solutions they need, either through report generators (typical a sub product of software packages) or through application development using productivity tools (Excel or Access). The result of this trend is, in most cases, the surge of "power users" and the consequent loss of control over existing systems and data redundancy, difficult to eradicate or integrate.

(2) To develop application software using fast development tools, minimizing the backlog, allowing version control as well as implementation of new software without suspension of work. The result of this trend is often the rise of costs with IS/IT, and it was hard, until recently, to find development tools with a favourable cost/benefit appraisal, when confronted with the same evaluation on specific solutions or ERP packages.

Currently these development tools have lower costs and lead to remarkable results in terms of development speed, implementation and maintenance. They are most efficient in specific processes for which packaged solutions are rare or inexist.

Thus, something this investigation has detected may be avoided: the scatter of packaged software on business processes, as well as difficulties when implementing interfaces to integrate with support processes (more common in financial areas).

(b) In the second case, the IS/IT team needs to develop interfaces to integrate data among application software from different sources, frequently using different integration technology.

V. **Conclusions**

The proposed model gathers a set of good practices that reviewed literature recommends as a success factor, either for new IS implementation or integration/modification of existing ones.

It is a generic approach and as such it can be used in other organizations of the hospitality industry. It can be considered a contribution for organizations of this industry who seek for a tool, not only to represent their businesses and information systems, but also to enable them to plan and develop strategies and respective implementation.

Under certain circumstances, organizations from the hospitality industry obtain advantages using this model, specifically when they look for an updated diagnosis of existing IS, or in the case of any restructuring due to reduced or increased activity. In such cases they may use this approach and apply it to their real situation..

References

[1] S. Spewak and S. Hill, Enterprise Architecture Planning: Developing a Blueprint for Data Applications and Technology.: John Wiley Sons, 1992.

[2] W. Orlikowski and J. Baroundi, "Studyng Information Technology in Organizations: Research Approaches and Assumptions," Information Systems Research, vol. 2 (1), pp. 1-28, 1991.

[3] A. S. Lee, "Integrating positivist and interpretative approaches to organizational research," Organizational Science, vol. 2 (4), pp. 342-365, 1991.

[4] J. W. Creswell, Research Design, Qualitative & Quantitative Approches.: Sage Publications, 1994.

[5] M. Saunders, P. Lewis, and A. Thornhill,.: Prentice Hall, 2007, ch. 4, pp. 100-128.

[6] J. Zachman, A Framework for Information Systems Architecture, vol. 26 (3), pp. 454-470, 1987.

[7] P. Sousa, C. Pereira, and J. Marques, Enterprise Architecture Alignment Heuristics, 2005.

[8] J. Ward and J. Peppard, Strategic Planning for Information Systems, John Wiley & Sons, 2002.

[9] J. Zachman. (1999, December) Information Management Magazine. [Online]. http://dmreview.com

[10] D. Garlan and D. Perry, "Introduction to the Special Issue on Software Architecture," IEEE Transactions on Software Engineering, vol. 21 (4), pp. 269-274, Abr 1995.

[11] M. Kozina, "Evaluation of ARIS and Zachman Frameworks as Enterprise Architectures," Journal of Information and Organizational Sciences, vol. 30 (1), pp. 115-136, 2006.

[12] J. Hoogervorst, "Enterprise Architecture: Enabling Integration, Agility and Change," International Journal of Cooperative Information Systems, vol. 13 (3), pp. 213-233, 2004.

[13] W. Hasselbring, "Information System Integration," Communications of ACM, vol. 43 (6), pp. 33-38, 2000.

[14] R. Winter and J. Schelp, "Enterprise Architecture Governance: The Need for a Business-to-IT Approach," Proceedings of the 2008 ACM symposium on Applied computing, pp. 548-552, March 2008.

[15] S. Fernandes, "Informação crítica como factor de sucesso nas organizações: objectivos e metodologia de abordagem," Spacial and Organizational Dynamics - Discussion Papers, vol. 2, 2009.

[16] S. Spewak and M. Tiemann, "Updating the Enterprise Architecture Planning Model," Journal of Enterprise Architecture, vol. 2 (2), 2006.

[17] J. Ward, P. Griffiths, and P. Whitmore, Strategic planning for Information Systems, 1990.

[18] J. Ward, Strategic Planning for Information Systems, John Wiley Series in Information Systems, 2008.

[19] A. Teltumbde, "A framework for evaluating ERP projects," International Jounal of Production research, vol. 38 (17), pp. 4507- 4520, 2000.

[20] B. Baki and K. Çakar, "Determining the ERP package-selecting criteria: the case of Turkish manufacturing companies," Business Process Management, vol. 11 (1), pp. 75-86, 2005.

[21] V. Kumar, B. Maheswari, and U. Kumar, "An investigation of critical management issues in ERP implementation: emperical evidence from Canadian organizations," Technovation, vol. 23 (10), pp. 793–807, 2003.

[22] X. Illa, X. Franch, and J. Pastor, "Formalizing ERP selection criteria," Proceedings of the 10th International workshop on Software Specification and Design, IEEE, pp. 1-6, 2000.

[23] G. Fitzgerald, "Evaluating information systems projects: a multidimensional approach," Journal of Information Technology, vol. 13, pp. 15-27, 1998.

[24] J. Muscatello and I. Chen, "Enterprise Resource Planning (ERP) Implementations: Theory and Practice," International Journal of Enterprise Information Systems, vol. 4 (1), pp. 63-83, 2008.

[25] M. Sumner, "Critical Success Factors in Enterprise Wide Information Management Systems Projects," Proceedings of the 1999 ACM SIGCPR Conference on Computer Personnel Research, pp. 297-303, 1999.

[26] T. Davenport, Mission Critical: Realizing the Promise ok Enterprise Systems. Boston, Massachusetts: harvard Business School Press, 2000.

International Journal of Advances in Computer Science and its Applications – IJCSIA
Volume 4 : Issue 1   *[ISSN 2250 – 3765]*

Publication Date : 09 January 2014

About the Authors:

Paula Serdeira Azevedo. Holds a PhD in Management Sciences by University of the Algarve, concluded in 2012, with an investigation in the area of Information Systems. She is a Professor at the University of the Algarve since 1997. She published several papers in international congresses and seminars. She is co-author of a book. Her work also includes publishing on international scientific journals as well as participation on scientific committees of international conferences.

Carlos Azevedo holds a MSc in Economics by the Technical University of Lisbon (ISEG), complemented with several training courses on Financial Management by the Catholic University of Lisbon. He holds the degree of Specialist, awarded by the University of the Algarve in 2011.He is an Assistant Professor at the University of the Algarve since 2010. He held several positions as a manager in GALP and REN, the latest being General Manager of the LNG Terminal at Sines, Portugal.

Mário J. B. Romão is Professor of Information Systems at ISCTE - IUL Institute University of Lisbon. He holds a PhD in Management Sciences by ISCTE-IUL and the Computer Integrated Manufacturing (Cranfield University). He accomplished an international certification in Project Management - PMP Best Practitioner Program by PMI.