AHP SUPPORT TO ESTIMATION OF THE INFORMATION SYSTEM (IS) SIGNIFICANCE TO THE BUSINESS PERFORMANCE, PARTICULARLY THE HOSPITALITY PERFORMANCE

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Abstract

Numerous resources and working practice indicate that information system consists of elements generally categorized as IT infrastructure, human IT resources and IT-enabled intangibles (Bharadwaj, 2000), which, to some extent, affect business performance. However, it has not been sufficiently explored which elements of the information system tend to impact it more and which less. Therefore, the main aim of the paper is to assess certain IS elements that influence business performance in general. It is supposed that the possibility of the assessment despite the complexity of IS elements and related decisions can be supported by using the AHP method.

Additionally, the obtained results are compared with the results of one of the author's previous studies based on the hospitality manager experience regarding the relationship between IS elements and hospitality performance.

Key words: *AHP method, IS (Information System), Information system elements, BSC model (Balanced Scorecard model), IT (Information technology), Business performance, Hospitality sector*

1. THEORETICAL BACKGROUND

1.1. IS and business performance

The first stand point of the research is focused on the interpretation of the IT and the IS. The literature indicates that there are different IS (and IT) terminologies and understandings. Orlikowski and Gash (1994), for example, explain IS as "any form of computer-based information system", while Kudyba et al. (2002) define IS as a set of technological items (hardware, software and telecommunications) that creates, saves, acquires, transmits, analyses and communicates data and information. A growing body of literature seeks to more formally incorporate the information technology (IT) as support to Information System (IS). IT refers to all of the computer based information systems used by company and their underlying technology. IS (Information System) as a set of interrelated components collect, manipulate and disseminate data and information to provide business purpose. Additionally, we support Wade and Hulland (2004) differentiation between IT and IS claiming that IT is resource-based, while the IS involves a combination of resources and capabilities that allows its productive exploitation.

The other stand points of the research are focused on theoretical debates on whether IS [1] supported by IT contributes or does not contribute to business performance? It seems that the value of IS has been the subject of numerous researches in the last two decades. As far as the relationship between IT supporting IS and business performance are considered the literature indicates three different relationships.

A group of authors (Bharadway, 2000; Dehning and Stratopoulos, 2003; Ray et al., 2004) claims that the implementation of IS results in positive effect on business performance. On the other hand, there are scholars who consider no relationship between IT supporting IS and business performance (Venkatraman and Zaheer, 1990; Carr 2003, 2004). Finally, the third view (Helpman and Trajtenberg, 1998) proposes the negative IT impact on business performance due to the time and resources needed to develop complementary production input. Although a range of studies has been conducted, they show mixed and inconclusive findings.

Consequently, based on theory and some previous empirical studies (Morgan, 2002; Rainer and Turban, 2008; Turban *et al.*, 2009; Turban and Volontino, 2010) we identified and adapted 9 specific IS items (security, reliability, integrity, data storage, networking, access to information, hardware and software renewal cycles, level of management support and IT literacy of staff) for further analysis. In

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[1] The abbreviation IS in further text is reffering on the information system (IS) suported by information technology (IT).

that context we expect that IS subdivided into smaller segments will provide more research area to assess the relationship between IS and business performance.

1.2. Business performance measurement systems

Nowadays, the great majority of business performance measurements are based on balanced view which is characterized by a balance between financial and non-financial measures of performance. The previous traditional performance measurement systems were characterised by shortcomings such as: lack of strategic orientation, inability to provide information about the preferences of customers (guests), manager's practice to minimize deviations from the standard instead of constantly improving business activity (Turney and Anderson, 1989) and general inconsistency of performance benchmarks (Lynch and Cross, 1991). As a result of growing criticism of traditional business performance measurement, development of new systems was initiated to create a balance between financial and non-financial performance measures (Bourne et al., 2000). These new measurement systems are based on the assumption that financial performance measurement systems need to be complemented by non-financial indicators, including the intangible aspects of the organization. Upgrading traditional financial measures to non-financial performance criteria of the organization resulted in the development of comprehensive performance measurement framework such as the Balanced Scorecard model (Kaplan and Norton, 1996), EFQM Excellence Model (European Foundation for Quality Management, 1988), Performance Measurement Matrix (Keegan et al., 1989), System Performance Pyramid (Lynch and Cross, 1991), and Results and Determinants Framework (Fitzgerald et al., 1991).

According to Marr and Schiuma (2003) the balanced scorecard currently seems to be the most influential and dominant concept used for measuring financial and non financial business performances. By merging different perspectives such as financial, customer, business process, and growth/development perspectives, the BSC affords managers a better understanding of the interrelationships and tradeoffs between competing performance dimensions and improves their decision making and problem solving outcomes (Werner & Xu, 2012). In recent years, the Balanced Scorecard (BSC) model has also been applied in the information technology (IT) field while the IT BSC is becoming a popular tool with its concepts widely dispersed by international consultant groups such as Gartner Group (Gremberger and Saull, 2001).

1.3. AHP method

The analytic hierarchy process (AHP) was developed by Thomas L.Saaty (2001) as a structured technique for analyzing complex decisions. The AHP process has been used to assist different corporate and government decision makers in solving decision problems such as choosing a telecommunication systems (Tam and Tummala, 2001) or choosing a product marketing strategy (Mohaghar et al, 2012).

More detailed, according to Saaty (2008) AHP is a theory of measurement through pair wise comparisons and relies on the judgements of experts to derive priority scales. Thus, AHP helps decision makers to find the assessment criteria one that best suits the previous goal(s) and their understanding of the problem. It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, as well as for relating those elements to overall goals, and for evaluating alternative solutions.

Users of the AHP first break down their decision problem into a hierarchy of more easily comprehended sub-problems and each one of them can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem.

In the context of this research, AHP seems to be an appropriate method to support our intention to find out the IS elements (criteria) that are most relevant for business performance (goals) perceived through four BSC perspectives (Figure 1):
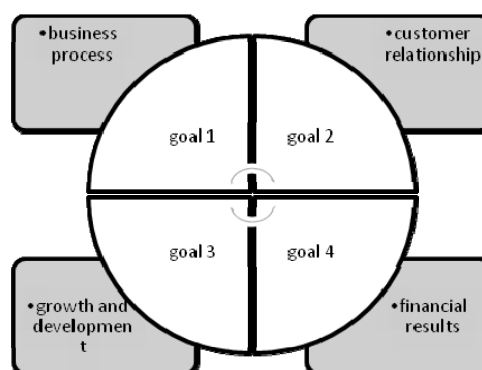

Figure 1: BSC concept adapted for AHP method

Aligned with the nature of research, the goals/objectives (4 BSC perspectives) are stated (Figure 2). Hereafter, the criteria (IS elements) are defined in accordance with up to date IT theories, concepts and

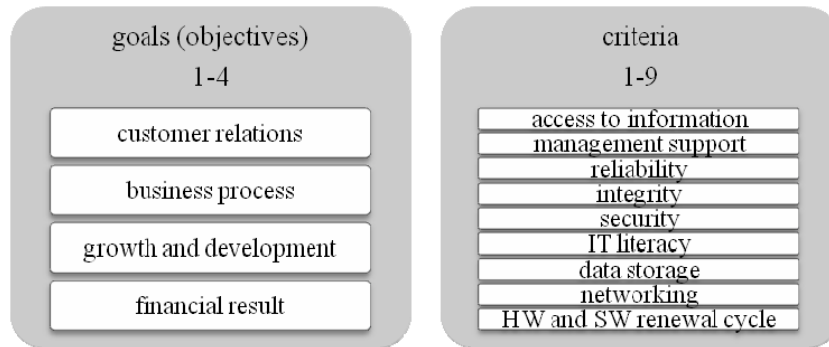working practice (Morgan, 2002; Rainer and Turban, 2008; Turban et al., 2009; Turban and Volontino, 2010).

Figure 2: Definition of research goals and criteria (defined by authors)

Both goals and criteria are then arranged in a hierarchical tree (Figure 3):
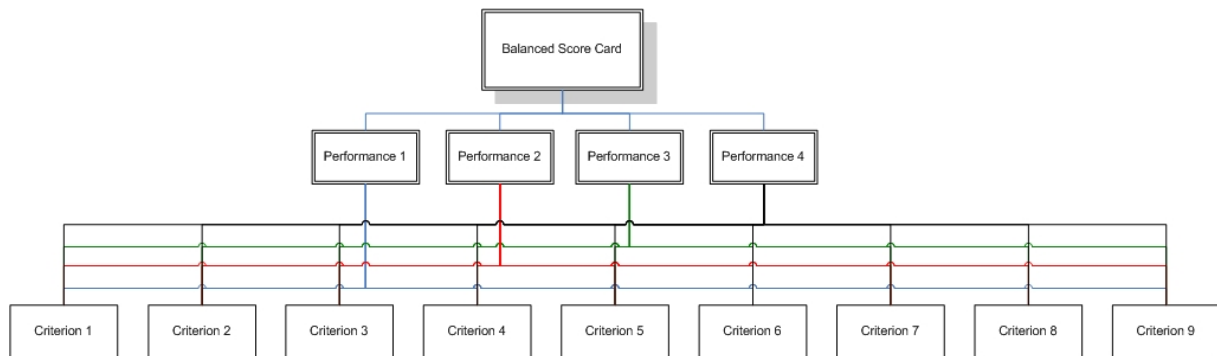

Figure 3: Hierarchical tree associated with previously defined goals and criteria (adopted by authors)

2. EMPIRICAL RESEARCH

2.1. Methodology and data

In order to determine the relative importance of the criteria, 10 IT experts dealing with computer science and information technology in their daily work, were interviewed.
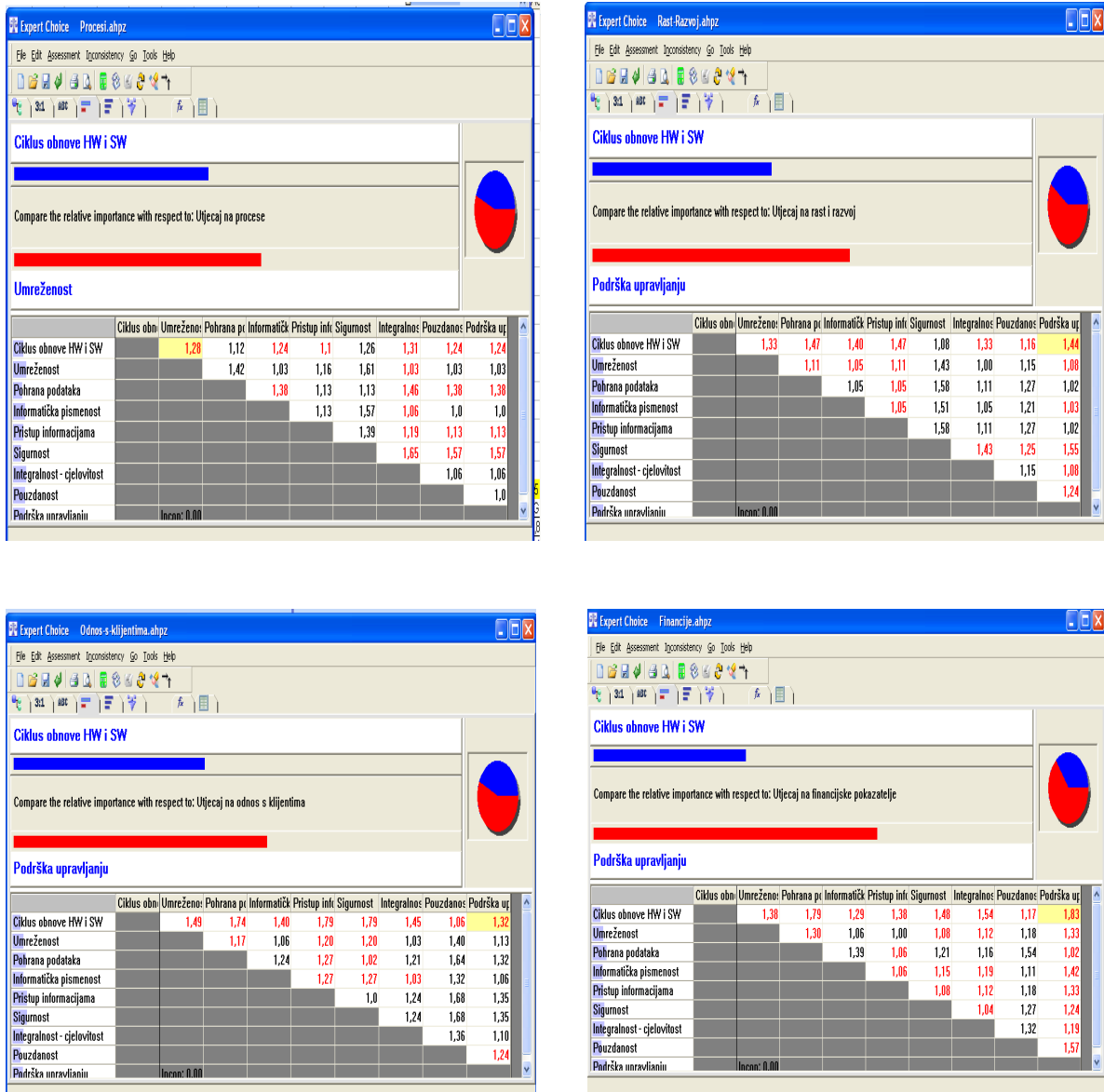
Figure 4: Data (pair wise matrix) inputed in Expert Choice software[2]

They assessed relative weight of each criterion to each of previously mentioned goals. Furthermore, by using pair wise comparison, the relative importance of one criterion over another is expressed. Expert

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[2] Since *the free trial* software license expired before the paper submission, above presented Figure 4 became unavailable for further editing. Thereafter, the following translation have to be enclosed:

- *Pristup informacijama =Access to information*
- *Podrška upravljanju= Management support*
- *Pouzdanost =Reliability*
- *Integralnost(cjelovitost)= Integrity*
- *Sigurnost =Security*
- *Informatička pismenost= IT literacy*
- *Pohrana podataka= Data storage*
- *Umreženost= Networking*
- *Ciklus obnove HW i SW= HW and SW renewal cycle*

judgement was made evaluating unique influence that each criterion has on each performance. Price range was from 0 to 10 with accuracy of 0.25 points. Those judgements were compared one by one creating pair wise matrix which means we have made 4 distinct processes of analysis, one per each performance. Having obtained the IT experts' judgement, all of their prices were averaged by each performance. On performance level each criterion had to be compared one by one to obtain the pair wise matrix containing their relative relationships. Result matrix was entered into Expert Choice (Figure 4) in order to get the normalized coefficients and to have final relationships and results.

2.2. Research results

For each perspective we obtained two sets of indicators. First set (figures under label "a" refer to the average value of IT expert judgments according to the questionnaire). Second set (figures under label "b") refers to the normalized coefficient for each business performance indicating its internal relationships.
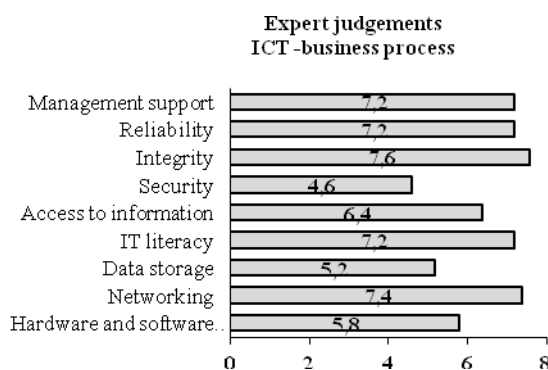

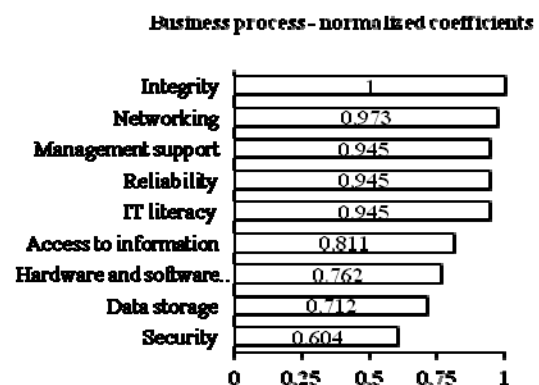*Figure 5a: Mean values of IT expert judgements*   *Figure 5b: Normalized coefficients*

According to the normalized coefficients for business process (Figure 5a and 5b) integrity is the most important criterion that contributes to the mentioned performance. Criteria such as networking and management support are ranked as 2nd and 3rd.

Regarding the customer relation perspective (Figure 6a and 6b), criteria (IS elements) such as access to information, security and data storage are indicated as those with the most relevant contribution to the observed perspective.
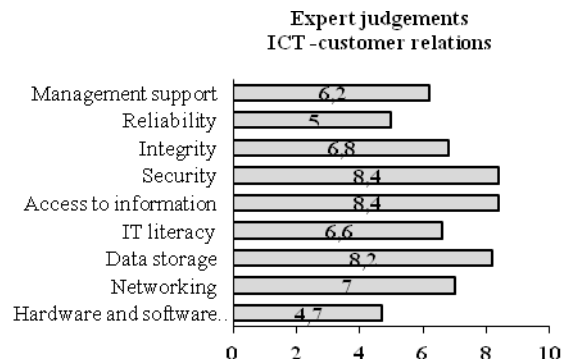
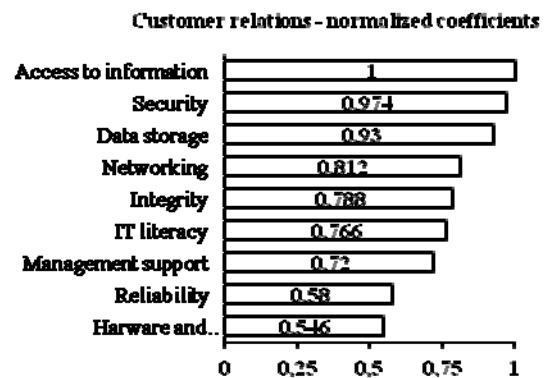*Figure 6a: Mean values of IT expert judgements*

Figure 6b: Normalized coefficients

Furthermore, access to information is the most important criterion that helps improve the growth and development perspective (Figure 7a and 7b). Data storage and management support are ranked as second and third and present another two important criteria with capacity to improve the growth and development perspective.
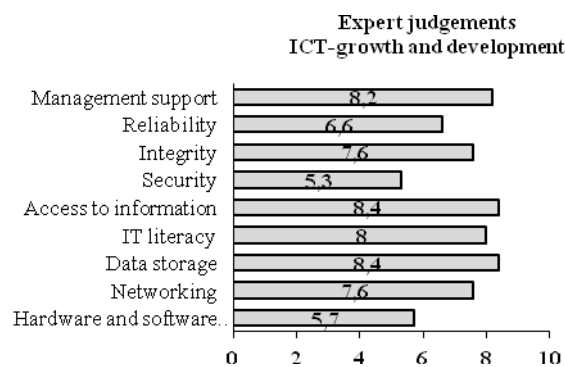

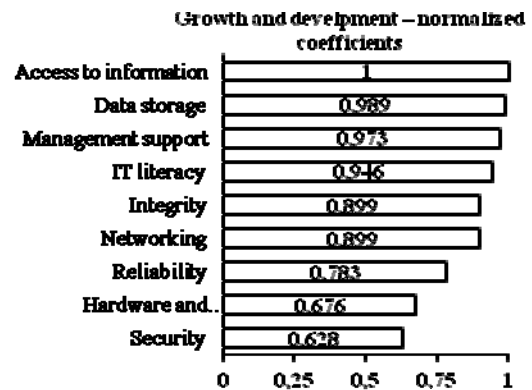*Figure 7a: Mean values of IT expert judgements*

Figure 7b: Normalized coefficients

Last set of results (Figure 8a and 8b) pointed out that information system with qualitative management support, data storage option and high level of data integration, offer the most appropriate support to company in attaining better financial results.
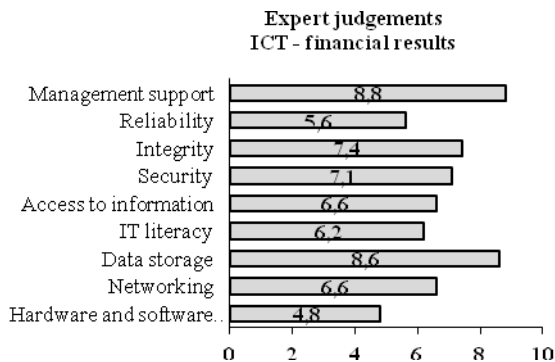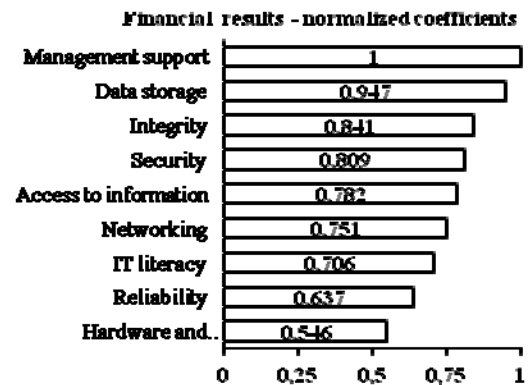
Figure 8a: Mean values of IT expert judgements

Figure 8b: Normalized coefficients

3. THE RESULTS INTERPRETATION IN HOSPITALITY SECTOR

In the final part of the paper, the authors have used the above presented research results as an information set to be compared with the results of one of the previous surveys (Garbin Praničević, 2010) focused on analyzing IT elements that, some more some less, influence the hospitality performance. The sample used in the previous study was the Croatian hospitality sector and its managers who gave their opinion and appraisals of IT influence on the same four (4) BSC perspectives. Although there are multiple modalities of measuring performance in hospitality industry, Nelly (2003) claims that frameworks based on the Balanced Scorecard (BSC) arising from Kaplan and Norton's initial study (1996) are the most appropriate for the hospitality industry.

Data (Garbin Praničević, 2010) are processed in SPSS and the discriminate analysis was used to single out those IT elements which affect a particular performance more than others. The obtained results for each observed performance were similar (but not the same) to the results obtained by AHP method in this study. For example, regarding customer relation performance, access to information and security were approved by AHP as the most important criteria (IS elements) that contribute to the mentioned performance. On the other hand, a stepwise method in SPSS also single out security, management support and software renewal cycle as those IS elements that are well connected with a better performance.

Also, regarding growth and development performance, access to information was approved by AHP as the most important criteria that contribute to this performance. According to the stepwise method in SPSS access to hotel information was ranked as 2nd most relevant IS element for its performance.

Finally, on each performance level, the SPSS results were compared to the AHP results. The main implication of the mentioned comparison is the opportunity to embed the elements (criteria) highly ranked by AHP into the hospitality IT knowledge base. It means that IT experts experience processed by AHP can serve to the future hospitality practice by:

- underlining elements (criteria) that the hotel managers have not recognized in their practice

- designing new framework for assessing a technological solution before its implementation.

4. CONCLUSION

The findings of this paper support the scholars (Bharadway, 2000; Dehning and Stratopoulos, 2003; Ray et al., 2004, Wade and Hulland, 2004) who argue that information system supported by new technology have enough capabilities to improve any business system. The AHP was demonstrated as an effective technique that supports authors' intention to explore IS as a complex set of associated IS elements (IS criteria) and to point out some of them as the most relevant for each of the observed business performance (goals). It has also been shown that the assessment, despite the IS complexity, can be supported by collaboration and decision-support software based on the AHP.

Furthermore, the obtained results were compared to the results of one of the author's previous studies based on the hospitality manager experience regarding the relationship between IS elements and hospitality performance. AHP method indicated some completely new and still not recognized IS elements as important in the context of performance contributions. Since the Croatian literature is still not covered with such type of study, this paper should amplify the present knowledge about IS elements that support business performance based on the balanced view (adopted from Kaplan and Norton's study, 1996). The practical implication can be expected in using the new framework for assessing technological solutions (alternatives) before final *buy or not to buy* decision.

And last, but not least, if the scholars perceived the IS as a set of constituent elements (not just an infrastructure unit), an appropriate analysis can reveal more "hidden" details with capacity to trigger the positive IT influence on business performance, including the hospitality performance. The only requirement, approved in the best practices, is that IS element should be on the same (or very similar) level of development. Practicality implications of the paper should be focused on the IT managers to pay more attention, and put more investments in those IS elements which have proved to be more significant for each of the four (4) business performances.

REFERENCES

Bharadway, A.S. (2000), "A resource-based perspective on information technology and firm performance: An empirical investigation", *MIS Quarterly, 24* (1), pp.169-196.

Bourne, M., Mills, J., Wilcox, M., Neely, A. and Platts, K. (2000), "Designing, implementing and updating performance measurement systems", *International Journal of Operations & Production Management,* Vol.20 No.7, pp.754-771.

Carr, N. (2003), "IT doesn't matter", *Harvard Business Review*, May, pp.5-12.

Carr, N. (2004), Does *IT matter? Information technology and the corrosion of competitive advantage,* Cambridge, MA: Harvard Business School.

Dehning, B. and Stratopoulos, T. (2003), "Determinants of a sustainable competitive advantage due to an IT-enabled strategy", *Journal of Strategic Information Systems*, 12 (1), pp.7-28.

Fitzgerald, L., Johnston, R., Brignall, S., Silvestro, R. and Voss, C. (1991): *Performance Measurement in Service Business* , CIMA, London.

Garbin Praničević, D.(2010): *Relationship between IS maturity and Hotel performance,* Doctoral thesis, University of Split, Faculty of Economics.

Grembergen, W. and Saull, R. (2001), "Aligning business and information technology through the balanced scorecard at a major canadian financial group: It's status measured with an it BSC maturity model", In: HICSS 2001: *Proceedings of the 34th Annual Hawaii International Conference on System Sciences* (HICSS-34), Washington, DC, USA, Vol. 8, p. 8061. IEEE Computer Society, Los Alamitos.

Helpman, E. and Trajtenberg, M. (1998), "A time to sow and a time to reap: growth based on general purpose technologies", in Helpman , E.(ed), *General Purpose Technologies and Economic Growth,* Cambridge, Mass.:MIT Press, pp. 55-83.

Hendricks K. and Singhal,V. (1996), "Quality Awards and the Market Value of the Firm: An Empirical Investigation", *Georgia Tech, Management Science* , Vol. 42, No. 3, pp. 415-436.

Kaplan, R.S. and Norton, D.P. (1996), "Using the Balanced Scorecard as a strategic management system", *Harvard Business Review,* 74 (1), pp.75-85.

Kaplan, R.S., and Norton, D.P.(1992), "The Balanced Scorecard – Measures that drive Performance", *Harvard Business Review* 70 (1), pp.71-79.

Keegan, D.P.*,* Eiler, R.G. and Jones, C.R. (1989)*, "*Are your performance measures obsolete?", *Management Accounting,* Vol. 70, pp 45–50*.*

Kudyba, S. and Romesh, K. (2002), *Information technology, corporate productivity, and the new economy*. Westport, CT: Quorum Books.

Lynch, R.L. and Cross,K.F.(1991)*, Measure Up-The essential Guide to Measuring Bussines Performanc*e, Mandarin, London.

Marr, B. and Schiuma, G. (2003), "Business performance measurement – past, present and future",

Management decision, Emerald 41/8, pp.680-687.

Mohaghar, A., Fathi, M.R., Zarchi, M.K. and Omidian, A.(2012), "A Combined VIKOR-Fuzzy AHP Approach Marketing Strategy Selection", *Bussines Management and Strategy*, Vol. 3, No. 1, pp.13-27.

Morgan, T. (2002), *Business Rules and Information Systems: Aligning IT with Business Goal*, Addison-Wesley.

Nelly, A., Marr, B., Roos, G., Pike, S. and Gupta, O. (2003), "Towards the third generation of performance measurement", *Controlling*, Vol.15, No.3/4.

Orlikowski, W.J. and Gash, D.C. (1994), "Technological frames: Making sense of information technology in organizations", *ACM Transaction on Information System (TOIS)-Special issue on social perspective on IS*, Vol.12, Issue 5, pp.147-207.

Rainer, K. and Turban, E. (2008), *Introduction to Information Systems: Supporting and Transforming Business*, 2nd edition, John Wiley & Sons, New York.

Ray, G., Barney, J.B. and Muhanna, W.A. (2004), "Capabilities, business processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view", *Strategic Management Journal,* 25*,* pp. 23-37.

Saaty, T. L. (2001), *Fundamentals of Decision Making and Priority Theory*, Pittsburgh, Pennsylvania: RWS Publications.

Saaty, T.L. (2008), "Decision making with the analytic hierarchy process", *Int. J. Services Sciences,* Vol. 1, No. 1, pp 83-98.

Tam,M.C.Y. and Tummala, V.M.R (2001), "An application of the AHP in vendor selection of a telecomunication system", *Omega 29 – The international Journal of Management Science*, pp. 171-185.

Turban, E. and Volontino, L. (2010), *Information technology for Management, Transforming Organization in the Digital Economy*, Wiley and Sons.

Turban, E., Rainer, R. K. and Potter, R. E. (2009), *Introduction to Information Systems*, Wiley-India.

Turney, P. B. B. and Anderson, B. (1989), "Accounting for continuous improvement", *Sloan Management Review*, 30 (2).

Venkatraman, N. and Zaheer, A. (1990), "Electronic integration and strategic advantage: Quasi-experimental study in the insurance industry", *Information Systems Research,* 1 (4), pp. 377-393.

Wade, M. and Hulland, J. (2004), „The resource-based view and information systems research: Review, extension, and suggestions for future research", *MIS Quarterly*, 28 (1), pp.107-142.

Werner, M. L. and Xu, F. (2012), "Executing strategy with the balanced scorecard", *International Journal of Financial Research, 3*(1), pp. 88-94.