ISSN: 1946-1836
Journal of Information Systems Applied Research
Volume 3, Number 20 http://jisar.org/3/20/ June 17, 2010

In this issue:

On Design Science, MCDM, and Outsourcing Decision Making

Doncho Petkov
Eastern Connecticut State University
Willimantic, CT 06226 USA

Olga Petkova
Central Connecticut State University
New Britain, CT 06050 USA

Abstract: This paper explores building Information Systems (IS) outsourcing decision models as design science artifacts within the conceptual process framework for carrying out design science research work in IS by Peffers. The design science artifact is developed using the Analytic Hierarchy Process (AHP), a multi-criteria decision making (MCDM) approach by Saaty. The paper presents a practical AHP model that integrates the findings from the most significant empirical research in IS outsourcing to date with the ideas of MCDM and design science. The need for such an integration is motivated by a disconnect between past AHP applications to outsourcing and previous behavioral IS outsourcing research. The contribution of this paper is that it provides a possible resolution to the disconnect by showing how the conceptual process approach for design science in IS can be used in a framework for integrating MCDM modeling with relevant results from existing empirical IS outsourcing research.

Keywords: Information Systems outsourcing, Design Science, outsourcing decision, AHP, analytic hierarchy process, MCDM, multi-criteria decision making

---

Recommended Citation: Petkov and Petkov (2010). On Design Science, MCDM, and Outsourcing Decision Making. *Journal of Information Systems Applied Research, 3* (20). http://jisar.org/3/20/. ISSN: 1946-1836. (A preliminary version appears in *The Proceedings of CONISAR 2009:* §3562. ISSN: 0000-0000.)

This issue is on the Internet at **http://jisar.org/3/20/**

The **Journal of Information Systems Applied Research** (JISAR) is a peer-reviewed academic journal published by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals (AITP, Chicago, Illinois). • ISSN: 1946-1836. • First issue: 1 Dec 2008. • Title: Journal of Information Systems Applied Research. Variants: JISAR. • Physical format: online. • Publishing frequency: irregular; as each article is approved, it is published immediately and constitutes a complete separate issue of the current volume. • Single issue price: free. • Subscription address: subscribe@jisar.org. • Subscription price: free. • Electronic access: http://jisar.org/ • Contact person: Don Colton (editor@jisar.org)

This paper was in the 2009 cohort from which the top 45% were accepted for journal publication. Acceptance is competitive based on at least three double-blind peer reviews plus additional single-blind reviews by the review board and editors to assess final manuscript quality including the importance of what was said and the clarity of presentation.

On Design Science, MCDM, and Outsourcing Decision Making

Doncho Petkov
petkovd@easternct.edu
Department of Business Administration
Eastern Connecticut State University
Willimantic, Connecticut 06226 USA

Olga Petkova
petkovao@ccsu.edu
Department of Management Information Systems
Central Connecticut State University
New Britain, Connecticut 06050 USA

Abstract

This paper explores building Information Systems (IS) outsourcing decision models as design science artifacts within the conceptual process framework for carrying out design science research work in IS by Peffers. The design science artifact is developed using the Analytic Hierarchy Process (AHP), a multi-criteria decision making (MCDM) approach by Saaty. The paper presents a practical AHP model that integrates the findings from the most significant empirical research in IS outsourcing to date with the ideas of MCDM and design science. The need for such an integration is motivated by a disconnect between past AHP applications to outsourcing and previous behavioral IS outsourcing research. The contribution of this paper is that it provides a possible resolution to the disconnect by showing how the conceptual process approach for design science in IS can be used in a framework for integrating MCDM modeling with relevant results from existing empirical IS outsourcing research.

Keywords: Information Systems outsourcing, Design Science, outsourcing decision, AHP, analytic hierarchy process, MCDM, multi-criteria decision making

1. INTRODUCTION

The importance of the decisions associated with implementing Information Technology (IT) outsourcing has been stressed in the literature (see Schniederjans et al. (2007)). The main reason is that "outsourcing makes up a substantial and rapidly rising part of expenditure across corporations and government agencies alike" according to Willcocks et al. (2007). It is related also to the contradicting evidence from various practitioner outlets like Gartner reports and others in favor and against outsourcing as presented in Lacity and Rottman (2008). We may note that outsourcing solutions that are appropriate in one instance may be counterproductive in others. This underlines the need to provide models that assist in outsourcing decision making for a given situation given its particular constraints.

Lacity et al. (2009), Willcocks et al (2007), King and Torkzadeh (2008) and others provide a detailed analysis of outsourcing research issues, successful practices and unresolved problems. One of them is the lack clear guidance how to make decisions in IT outsourcing (see Dhar, 2009). Existing publications do not provide clear set of procedures for outsourcing decisions apart from general recommendations based on empirical research about the role of single factors. It can be noted that decisions like a selection of what components of the IT operation to be contracted, choice of a vendor, prioritiza-

tion of the risks associated with outsourcing are complex. They involve many criteria and different variables. Very often, factors play a role to a degree, depending on multiple managerial perspectives. Venkatraman (1997) indicates the need for multidimensional measures in outsourcing decisions though he does not indicate an operational approach for the use of such measures. IT outsourcing decisions can be grouped into three broad categories: issues to whether to outsource the IT operations, including selection of activities to outsource; selection of outsourcing providers and decision related to aspects of the management of the relationship between the clients and the outsourcing providers. We focus in this paper only on the first category for space reasons.

Huizingh and Vrolijk (1996) pointed the potential for using a multicriteria decision making (MCDM) approach, the Analytic Hierarchy Process (AHP) (see Saaty,2008a) in IT outsourcing management as one of the possible Information Systems applications of AHP. Among some of the early applications of AHP to IT outsourcing could be listed Petkov and Petkova (1999), Udo (2000) and Yang and Hwang (2000). A closer analysis shows that the structure of the models discussed in these papers is determined largely by practitioners and is not always well justified.

It should be noted that the applications of MCDM in the field of Information Systems (IS) have spread little beyond the MCDM community over the years. They have not been recognized sufficiently in the traditional IS research literature partly because of the fact that the latter had focused its attention previously mostly on behavioral aspects of IS. The fundamental contribution to IS research by Hevner et al. (2004) aimed to restore the balance between the two inseparable areas of IS research – behavioral research and design science research. At the same time they show the complementary role of design science and behavioral science approaches in IS research. The surge of interest towards design science in IS research since 2004 presents an opportunity for broadening IS outsourcing research from a design science point of view and was one of the motivations for our work.

Peffers et al (2006) provide a process model for doing Design Science research in IS, presented here in an abbreviated form:

"*1. Problem identification and motivation.* Define the specific research problem and justify the value of a solution. Since the problem definition will be used to develop an effective artifactual solution, it may be useful to atomize the problem conceptually so that the solution can capture the problem's complexity… Resources required for this activity include knowledge of the state of the problem and the importance of its solution.

2. Objectives of a solution. Infer the objectives of a solution from the problem definition. The objectives can be quantitative, e.g., terms in which a desirable solution would be better than current ones, or qualitative, e.g., where a new artifact is expected to support solutions to problems not hitherto addressed. The objectives should be inferred rationally from the problem specification. Resources required for this include knowledge of the state of problems and current solutions and their efficacy, if any.

3. Design and development. Create the artifactual solution. Such artifacts are potentially, with each defined broadly, constructs, models, methods, or instantiations (Hevner et al. 2004). …Resources required moving from objectives to design and developments include knowledge of theory that can be brought to bear as a solution.

4. Demonstration. Demonstrate the efficacy of the artifact to solve the problem. This could involve its use in experimentation, simulation, a case study, proof, or other appropriate activity. Resources required for the demonstration include effective knowledge of how to use the artifact to solve the problem.

5. Evaluation. Observe and measure how well the artifact supports a solution to the problem. …At the end of this activity the researchers can decide whether to iterate back to step 3 to try to improve the effectiveness of the artifact or to continue on to communication and leave further improvement to subsequent projects. The nature of the research venue may dictate whether such iteration is feasible or not.

6. Communication. Communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its de-

> sign, and its effectiveness to researchers and other relevant audiences, such as practicing professionals, when appropriate. …Communication requires knowledge of the disciplinary culture."

The work reported in this paper is informed by the process of doing design science research suggested by Peffers et al (2006).

Carlsson (2006:198) points that an "IS design science research framework should be explicit on what should be produced, that is, what kind of design knowledge should be developed". According to Carlsson (2006) "IS design science research should develop practical design knowledge to solve classes of IS problems…A user (IS professional) of the abstract design knowledge has to "transform" the knowledge to fit the specific problem situation and context." Carlsson's thoughts and the process by Peffers et al. (2006) have in our opinion common ground with the way how MCDM models are developed by decision makers for the last thirty years (for details on MCDM see Saaty, 1994; 2008a).

The goal of this paper is to provide an AHP model for decision making in IS outsourcing as a Design Science artifact that is integrating MCDM modeling of outsourcing decisions with the knowledge from behavioral research in outsourcing management. The need for such an integration is inspired by the disconnect between MCDM applications to outsourcing and behavioral IS outsourcing research outlined earlier and studied further in the next two sections.

The contribution of this work is that it provides a possible resolution for the above disconnect by showing how the concepts of Design Science and the process suggested by Peffers et al. (2006) can be used as a framework for integrating MCDM modeling with results from empirical IS research. The paper proceeds with a summary of the most significant recent behavioral IS research publications on outsourcing, followed by a brief overview of Analytic Hierarchy Process and its applications to outsourcing. Then an AHP model for deciding what activities to outsource is proposed based on best results in empirical IS research in outsourcing, followed by concluding considerations.

2. BRIEF REVIEW OF TRADITIONAL IS RESEARCH ON THE OUTSOURCING DECISION

Palvia (2002) quotes a statement of a market research company that 70% of IT managers lack the experience to manage an outsourcing project in a way that maximizes shareholder value. This underlines the need for improvements both in outsourcing theory and in practice. One possible reason for the poor state of affairs in IS outsourcing management is that "many authors focus their interests only on some phases of the overall process of outsourcing "(Franceschini and Galetto, 2003:247).

Past publications on IS outsourcing management can be placed in two groups. The first one is bigger and is based on ongoing empirical and case study research generating broader outsourcing management guidelines to particular aspects of an outsourcing project. Lacity and Rottman (2008) among others have produced guidelines for offshoring work based on interviews with representatives from 25 client organizations, 33 supplier organizations and 10 offshore advisor firms. They focus mainly on the client organization in outsourcing and investigate seven roles of the client organization chief information officer (CIO): establish expected IT and business benefits, select the right approach to outsourcing, enamor suppliers by being an attractive client, communicate the outsourcing strategy to all stakeholders, provide enough resources to implement the sourcing strategy, build social capital with key supplier executives, seek independent assessment of sourcing strategy initiatives. While the roles are important for improved outsourcing decisions there is little guidance on how these decisions can be made in practice.

Navarrete and Pick (2002) investigate selective IT outsourcing in the banking industry. Their empirical analysis derives organizational, project and provider variables grouped in a descriptive framework of making IT outsourcing decisions including a total of 22 factors. While their findings are providing insights in the ways how outsourcing decisions are made in general they seem to be of little value for a manager due to the enormous number of factors involved and the lack of a framework for their application.

Two of the most influential researchers in IT outsourcing, Lacity and Willcocks (2001) provide as a result of extensive long term empirical work three separate two dimensional decision models as 2 by 2 matrices. It is hard to understand however how these models can be applied in practice only one at a time as the authors seem to imply. Their study however is valuable for the solid empirical work leading to identification of the factors involved in these 2 by 2 models. The next section of the paper presents further analysis of the findings in Lacity and Willcocks (2001) and our MCDM extensions of their ideas.

The second category is smaller in terms of number of publications and refers to a few attempts to capture the whole IS outsourcing management process and associated decision making. A structured general model for the management of outsourcing processes is presented by Franceschini and Galetto (2003). They provide an integrated framework for making IT outsourcing decisions that combines benchmarking, multicriteria decision aid methods, cost analysis and other process planning methodologies. Their methodology is somewhat linear in nature but as a whole seems more realistic than the general recommendations from traditional empirical IS research. A broader integrated framework for management of information technology outsourcing is presented by Fjemerstad and Saitta (2005). Yet another general decision framework to guide managerial decision making on IS outsourcing is presented in King (2008). While the latter is useful in focusing managerial attention to the relevant issues at every step of the whole outsourcing process it does not provide any guidelines on how decisions are made and that is another motivation for us to apply MCDM in outsourcing.

The existing literature on outsourcing leads to a conclusion about the importance of decision making that takes into account the specific conditions of the client, the outsourcing providers and any other relevant stakeholders. This underlines the need to provide models that assist in decision making for a particular situation. Our brief revue shows that mainstream empirical IT outsourcing research has mostly avoided the application of multicriteria approaches with few exceptions. The existing behavioral IS research literature does not provide a procedure for making specific outsourcing decisions apart from general recommendations.

The brief analysis in this section serves as an illustration of the value of traditional behavioral outsourcing research for generating the kind of knowledge needed for the first step in the process of applying Design Science proposed by Peffers et al (2006) when applied to decision making in outsourcing. The next section aims to identify the knowledge needed for the remaining steps in their process when generating a design science solution to the problem of deciding what to outsource.

3. ON THE ANALYTIC HIERARCHY PROCESS AND ITS APPLICATIONS TO OUTSOURCING DECISIONS

An introduction to AHP

The field of Multiple Criteria Decision Making (MCDM) evolved since 1980 into a set of powerful approaches suitable for complex managerial problems. These can be summarized in three groups: Multiattribute Utility Theory (MAUT), the French Outranking Methods like PROMETHEE and the Analytic Hierarchy Process (AHP) (see Saaty, 1994, Saaty, 2008a). The latter method has gained the widest acceptance in the world by practitioners and scholars (Yu and Chen (2005)). It is true that it is criticized by proponents of the other two schools of thought. Criticism by proponents of utility theory is based on the questionable assumption that its axioms can be used to judge a different decision making approach like AHP, which is based on different axiomatic foundations (see Saaty, 1994). Then the decisive criterion for the validity of an approach should be how widely it is used in practice and on this indicator AHP is unsurpassed (Yu and Chen (2005)).

A complex problem is structured in AHP in the form of a hierarchy. The upper levels contain the goals while the following layers hold factors affecting them and the alternative choices to be made. Unlike mathematically naive "scoring" approaches in which an alternative is assigned an absolute score usually with respect to the overall goal, the Analytic Hierarchy Process breaks down the task of prioritization into simpler problems related to the pairwise evaluation of factors in the hierarchy with respect to their contribution only to the element in the root of a

particular cluster of the hierarchy (see Saaty, 2008a).

To address the fact that some variables are quantitative while others are qualitative, a measurement ratio scale from 1 to 9 is used in these comparisons translating thus all quantitative and qualitative facts into human judgments (see Saaty, 1994, Saaty 2008a). When two compared factors are considered equally important, then a value of 1 is entered. If the first factor is slightly more important than the second, then a value of 3 represents that, while 5 means strong importance, while 7 and 9 mean respectively very strong and absolute importance. Values of 2, 4, 6 and 8 represent intermediate cases. It can be noted that these comparisons form a matrix of comparisons for each cluster. As the matrix is reciprocal, meaning that the elements below the main diagonal are symmetrically reciprocal to those above it, it is sufficient to provide only the judgments above the main diagonal, while those that are on the main diagonal are equal to 1.

Notice that the judgments described in the preceding paragraph represent ratios of the weights of the factors that are being compared. The purpose of an AHP model is to restore the actual weights. The mathematics involved in the calculation of these weights is based on the theory of matrix eigenvalues and eigenvectors (see Saaty,1994). The resulting weights of the factors obtained as the elements of the eigenvector corresponding to the largest eigenvalue of the comparison matrix represent their local priorities towards the root of the respective cluster (see Saaty, 1994). These are used for the synthesis or calculation of the overall importance of an element in the hierarchy towards the main goal in the root of the hierarchy. It is also called global priority of a factor within the hierarchy. Note that these global priorities are normalized which means that the sum of the priorities of the elements within a level of the hierarchy is equal to 1. The latter is convenient in ranking and in using priorities for the allocation of resources in proportion to the weights of the alternatives.

The steps in AHP modeling (see Saaty, 2008a) are implemented using several software packages such as Expert Choice and Creative Decisions. The application of AHP leads to improved transparency of decision processes, the creation of a decision audit trail and greater acceptance and legitimacy of the decisions (see Saaty, 1994, 2008a). The discussion on AHP leads to a conclusion on the relevance and applicability of MCDM for operationalizing the process for design science research suggested by Peffers et al. (2006) to outsourcing decisions.

Recent applications of AHP to outsourcing decisions

We have focused on AHP for modeling outsourcing decisions as it is the most widely used MCDM approach as noted earlier (see Yu and Chen, 2005) and for the advantages of the pairwise comparison method that it utilizes as discussed in Saaty (2008a; 2008b). The next paragraphs present an analysis of outsourcing decision modeling that has been reported predominantly in the literature on operations research.

Pandey and Vasal (2004) propose two AHP models: one for choosing activities to outsource and another to choose the appropriate outsourcing methodology. For the first one they provide without any particular justification three criteria: criticality, stability and simplicity associated with the activities under consideration. These are verified subsequently through interviews with twenty IT managers. We may note however that there is no particular link between their work and past traditional research on IS outsourcing.

Hwang (2005) presents a web based decision support system using fuzzy AHP to assist in the make or buy decision. The AHP model however does not include any elements from previously published research on the make or buy decision.

Wang and Yang (2007) have considered six criteria: economics, resources, strategy, risk, management and quality in their proposed use of a combination of AHP and PROMETHEE. Their literature review covers relevant traditional research on outsourcing and the derived criteria are based on it. However the criteria in their approach are determined at the end by a group of managers and hence it is hard to judge to what degree their knowledge reflects the state of the art on the decision whether to outsource or not.

Udo, Kirs and Bagchi (2008) provide an AHP model for evaluating what activities to outsource. They quote a practitioner source for

justifying the criteria included in their model: the strategic importance of the IS function in question, economic considerations, project attributes, vendor issues, and industry or environment issues. While these criteria make sense, they are based on a single source that is not reflecting fully the vast amount of IS research associated with IT outsourcing.

It may be concluded that past research on applying MCDM to IT outsourcing decisions is based mostly on intuitive selection of criteria that are not justified sufficiently on the basis of earlier behavioral research in IT outsourcing. Hence our conclusion that there is a disconnect between MCDM outsourcing models and traditional IT research. We propose to resolve this issue through an application of AHP to outsourcing decision making which is informed by the best behavioral outsourcing research following a similar process to the one suggested by Peffers et al. (2006) as is illustrated in the next section.

4. ON A PROPOSED STRUCTURE AND PROCESS OF AN AHP MODEL FOR SELECTION OF IT ACTIVITIES TO OUTSOURCE

This section outlines the methodology of the proposed design science approach to outsourcing decision making. In line with the dual understanding of design by Hevner et al. (2004) as a process and as an artifact we will outline first our proposed structure for the AHP model as a design artifact assisting better outsourcing decision making and then we will discuss the process of building and using such a model and its application in a real problem.

Lacity and Willcocks (2001) present probably the deepest investigation of offshoring outsourcing practices based on 1500 interviews. In a chapter dedicated to the outsourcing decision, they provide three separate two dimensional models involving:

> contribution of the IT activity to the business positioning and contribution to the business operations;
>
> in-house scale and management practices with respect to the best industry practices;
>
> degree of IT integration and technology maturity.

While the depth of their findings is not questionable we may conclude that their suggestion that each model may be used on its own in isolation as if the other factors do not play a role is not very realistic as all factors in their three models are interconnected and affect the outsourcing decision in a systemic way. The fragmented consideration of the above six criteria in the three 2 x 2 models in Lacity and Willcocks (2001) is complicating the decision making process. A practical integrated approach is needed that combines the various quantitative and qualitative aspects of the six major factors affecting a decision to outsource identified by Lacity and Willcocks (2001). It should support individual or group decision making on the problem reflecting the constraints and conditions of a specific organization.

We propose an AHP model for the outsourcing decision satisfying the above requirements. It is an improvement over the work by Lacity and Willcocks (2001) as it links their significant insights from extensive empirical research on outsourcing practices with the benefits provided by AHP modeling discussed earlier in the paper. Thus we illustrate how to integrate best results in behavioral outsourcing research with Design Science outsourcing work using AHP for defining the design artifacts thus assisting better outsourcing decision making.

FIRST TWO LEVELS OF THE HIERARCHY FOR THE SELECTION OF AN ACTIVITY TO BE OUTSOURCED

Main goal	**Criteria (second level)**
Best candidate for outsourcing	Contribution of IT activity to business operations
	Contribution of IT activity to business positioning
	Importance of best managerial practices for the activity
	Possibility for achieving economies of scale
	Degree of technological maturity of the activity
	Degree of integration with other business activities

The first two criteria in the hierarchy are associated by Lacity and Willcocks (2001)

with the selection of the activities to outsource. The third and fourth criteria are abstractly linked to economic considerations of the outsourcing decision while the fifth and the sixth are linked to the selection of an appropriate contract (Lacity and Willcocks, 2001). The *structure of the proposed AHP model* is described next.

Other elements in the analytic hierarchy for outsourcing activity selection at the next levels are:

Third level – intensities for measuring the criteria.

Fourth level – possible alternatives, the activities considered for outsourcing.

We may note that up to the third level of the hierarchy the decision makers use pairwise AHP comparisons using the 1-9 scale (Saaty, 1994, Saaty, 2008a), while at the last level they use the rating or absolute comparison mode (see Saaty, 1994).

The proposed approach is a better decision model for outsourcing decisions as it provides a decomposition of the complex problem of selecting activities to outsource into many smaller tasks associated with simple pairwise comparisons of factors in the hierarchy. It provides also for control of decision makers' subjectivity and potential inconsistencies in the judgments (Saaty, 2008a) and ensures greater acceptance of the decisions by the stakeholders involved.

The first two criteria in our model and in Lacity and Willcocks (2001) are very similar to the two criteria considered in King (2008) in his framework for outsourcing decisions: core competences of the organization and critical success factors. Since Lacity and Willcocks (2001) include not two but six criteria, we believe that building our model along their work provides for a better multifaceted decision model than a one using only the ideas of King (2008). The above considerations aim to show that Design Science work in outsourcing and MCDM modeling in particular should be guided by an evaluation of the best available results in traditional IS outsourcing research if we strive to eliminate the disconnect between behavioral and MCDM/Design Science research in outsourcing outlined from our earlier discussion.

The suggested ***process to apply the model*** in a particular organization (based partly on Saaty, 1994, Peffers et al. (2006) and our experience in using AHP in various IT problems) is summarized below:

1. Problem identification within a group of relevant stakeholders.

2. Criteria and factor definition for the outsourcing decision model informed by the work of Lacity and Willcocks (2001).

3. Gathering of relevant data on the factors and the activities to outsource.

4. Pairwise comparisons of the criteria by managers or an IT steering committee that reflect the management priorities for the particular decision.

5. Conducting a series of meetings with groups of stakeholders to capture their values in the form of judgments regarding the pair-wise comparisons between the factors in the lower levels of the hierarchy and the evaluation of the alternatives in the last level.

6. Using AHP software for calculation of the local priorities of factors in the hierarchy and synthesis of the global priorities of each criterion, factor and alternative.

7. Simulation of various what-if scenarios that explore the impact of different criteria weights in the model on the priorities of the alternatives.

8. Making an informed decision that is based on the organizational learning taking place as a result of applying the model to the particular outsourcing decision situation of concern and communicating it to other interested parties to institutionalize it within the organization or share as a best practice with the research community.

Note that steps 1 and 2 above correspond to similar steps in the process defined by Peffers et al (2006). Steps 3-6 correspond to steps 3 and 4 suggested by Peffers et al (2006). This nature of our steps corresponds to the action research features of MCDM modeling since the models are built in close interaction between the researcher/facilitator and the decision makers/stakeholders. Our seventh step correspond to step 5, Evaluation as suggested by Peffers et al. (2006), while the last step in

our process is equivalent to the Communication step suggested by Peffers et al. (2006).

It is essential to stress the fact that a decision on a AHP problem emerges as a result of the learning taking place during the process. Sometimes any communication involved may not be linked directly to the stakeholders who participated directly but to other external parties that might be interested in the outcome of the decision. We may conclude that our process is an operationalization of the more general one by Peffers et al.(2006) that it is better suited to the nature of AHP models and MCDM in general as design science artifacts.

We should note that the complexity of the mathematics of the procedure is hidden from the users. The art of facilitating group decision making in AHP is in the ability of the group process facilitator to guide the formulation of the model in line with the body of knowledge from behavioral outsourcing research, to explain the meaning of pairwise and absolute AHP comparisons in a simple manner to the stakeholders, the ability to guide the stakeholders in mapping what is known about criteria, factors and alternatives into human judgments using the AHP scale and the role of what-if analysis for simulating scenarios.

A similar model was applied in practice in a large intervention facilitated by the authors. It was aimed at the selection of IT activities to outsource within a Central Applications Office for all universities in the province of Kwa Zulu Natal, South Africa. Numeric details on the case are not presented here for space reasons and they are not essential as the focus of this paper is on the outline of the methodology that was followed. A brief summary of our experiences in applying the model is provided below:

- The use of the multi-criteria approach introduced a disciplined way of thinking for the large stakeholder group.
- Although subjectivity was inevitable in such a human decision making process, the multicriteria approach for outsourcing decisions provided a way to control it through the consistency ratio measure, thus ensuring the integrity of the judgments in the model (see Saaty, 2008a).
- The mathematical details of the approach were of little interest to the members of the group however our experience with other multicriteria problems indicates that some explanations might be always appropriate depending on the stakeholders.
- The transparency of the process enhanced the legitimacy of the final decision which was accepted relatively well by the stakeholders.

5. CONCLUSIONS AND POSSIBLE FUTURE RESEARCH

This paper demonstrated how MCDM in general and the Analytic Hierarchy Process in particular can be used within a Design Science context to integrate significant existing knowledge in behavioral outsourcing research into a multicriteria model for outsourcing decisions. The MCDM approach provides a richer multidimensional perspective for understanding outsourcing decisions in a particular situation.

Possible future work includes research on applying the proposed model to different organizational settings and gathering the reflections of the stakeholders on such interventions as is recommended by Carlsson (2006). Another direction for future work is linked to the need to assess how interdependent are the factors involved in the model and if relevant, the possible application of an AHP extension for such problems, called the Analytic Network Process (ANP) (see Saaty, 2008a). Hence our starting assumption that it is sufficient to model the problem as a hierarchy without feedback dependencies might be a limitation of our work reported here. This however should be addressed by investigating in the future the appropriateness of a relevant ANP model and its efficiency compared to the proposed hierarchical model through further field applications and comparisons between appropriate hierarchical and network models for similar decisions.

Saaty (2008a) indicates the need in future work in AHP to "integrate and catalogue of the structure of a variety of carefully studied decisions to create a dictionary to serve as a source of reference for others to consult, so they can benefit from the knowledge that went into making these decisions". However

as was pointed earlier in the paper, our literature review on AHP applications to outsourcing raises an issue about the quality of the existing published models to be considered for such a catalogue. We found that past research on applying MCDM to IT outsourcing decisions is based mostly on an intuitive selection of criteria that is often not justified sufficiently or not grounded well in traditional IS research on IT outsourcing.

The general challenge for the IT field is to integrate best practices and the body of knowledge in behavioral IS research in a particular problem area with the expressive power of MCDM modeling as is demonstrated in this paper and generate through such activities design science artifacts in the form of relevant reusable models following a structure and a process by analogy to the one outlined in this paper.

The proposed AHP model for outsourcing decision making aims to improve decision making in outsourcing through integrating the findings from extensive empirical research in IT outsourcing management with MCDM as a design science approach. Such a model needs to reflect the knowledge base associated with outsourcing management (see further discussion of its content in King (2008)). It has to be applicable also to the conditions of a specific organization, reflecting various quantitative and qualitative factors affecting a decision to outsource. This paper attempts to show how the Design Science process suggested by Peffers et al (2006) can be operationalized for the development of a holistic multicriteria model for the selection of IT activities to be outsourced. The results from this research aim to contribute to the wider use of MCDM for building Design Science artifacts in Information Technology research.

ACKNOWLEDGEMENTS

The authors are grateful to the anonymous reviewers and to the Editor for their comments which helped them in revising the paper.

REFERENCES

Carlsson, S. A. (2006) "Towards an Information Systems Design Research Framework: A Critical Realist Perspective", Proceedings DESRIST 2006. February 24-25, 2006, Claremont, CA.

Dhar, S. (2009), "Current Trends in Global IS Outsourcing", Proceedings AMCIS 2009.

Fjermestad, J. and J. Saitta (2005) "A Strategic Management Framework for IT Outsourcing: A review of the Literature and the Development of a Success Factors Model." Journal of Information Technology Cases and Applications Research, 7,3 (2005).

Franceschini, F., M. Galetto, M. Pignatelli, M. and M. Varetto (2003) "Outsourcing: guidelines for a structured approach." Benchmarking: an International Journal, vol 10, No 3, 246-260.

Hevner, A. R., S.March, J. Park and S. Ram (2004) "Design Science in Information Systems Research". MIS Quarterly, 28(1), pp. 75-105

Huizingh, E.K.R.E. and H.C.J. Vrolijk, (1996) "Decision Support for Information Systems Management: Applying Analytic Hierarchy Process", Proceedings ISAHP, Vancouver.

Hwang, H.S., (2005) "Web–Based Multiattribute Analysis Model for Make or Buy Decision". Proceedings ISAHP 2005, Honolulu.

King, W. (2008) "An IS Offshore Outsourcing Framework: Emerging Knowledge Requirements for IS Professionals." Journal of Information Technology Case and Application Research; 10 (4), pp. 7-31.

King, W., Torkzadeh, G. (2008), "Information Systems Offshoring: Research Status and Issues", MIS Quarterly Vol. 32 No. 2, pp. 205-225

Lacity, M.C. and J. Rottman (2008) Offshore Outsourcing of IT Work: Client and Supplier Perspectives, Pallgrave-Macmillan.

Lacity, M.C. and L.P. Willcocks (2001) Global Information technology Outsourcing: In Search of Business Advantage, Wiley.

Lacity, M.C., Khan, S.A., Willcocks, L.P. (2009) "A review of the IT outsourcing literature: Insights for practice". Journal of Strategic Information Systems, 18, 130–146.

Navarrete, C. J. and J. Pick (2002) "Initial Selective Information Technology Outsourcing: An Exploratory Study of Cases of

Large Organizations in Mexico." Journal of IT Cases and Applications, Vol 4, No 1.

Palvia, S.C.J. (2002) "Is e-Commerce Driving Outsourcing to Its Limits?." Journal of Information Technology Cases and Applications, Vol. 4, No.1, pp. 1-5.

Pandey, V. and V. Bansal (2004) "A Decision-Making Framework for IT Outsourcing using the Analytic Hierarchy Process." Proc. Of International Conference on Systemics, Cybernetics and Informatics, NISIET, Government of India, pp. I-VII

Peffers, K., T. Tuunanen, C.E. Gengler, M. Rossi, W. Hui, V. Virtanen and J. Bragge (2006) "The Design Science Research Process: A Model for Producing and Presenting Information Systems Research." Proceedings DESRIST 2006. February 24-25, 2006, Claremont, CA.

Petkov, D. and O. Petkova, (1999) "Making Decisions in Information Technology Outsourcing" Fifth International Conference of the Decision Sciences Institute, Athens, Greece, July 1999

Saaty T. L. (1994) Fundamentals of Multiple Criteria Decision Making with the Analytic Hierarchy Process, RSW Publications, Pittsburgh, 1994.

Saaty, T.L. (2008a) "Decision Making with the Analytic Hierarchy Process". International Journal of Services Sciences, vol 1 (1), pp. 83-98.

Saaty, T.L. (2008b) "Relative Measurement and Its Generalization in Decision Making Why Pairwise Comparisons are Central in Mathematics for the Measurement of Intangible Factors The Analytic Hierarchy/Network Process." RACSAM Rev. R. Acad. Cien. Serie A. Mat., vol. 102 (2), pp. 251-318.

Schniederjans , M.G, Schniederjans, A.M. and Schniederjans, D.G. (Eds). (2007). Outsourcing management information systems, IGI Global, Hershey.

Udo, G.G. (2000). "Using analytic hierarchy process to analyze the information technology outsourcing decision." Industrial Management & Data Systems,*100*(9), pp. 421-429.

Udo, G., P. Kirs, K. Bagchi, (2008) "Comparing Outsourcing Options for Software Development Projects Using the Analytic Hierarchy Process". Proceedings 2008 Decision Sciences Institute Conference.

Venkatraman N. (1997) "Beyond Outsourcing: Managing IT Resources as a Value Centre." Sloan Management Review, Spring, pp. 51-64.

Wang, Jian-Jun and De-Li Yang (2007) "Using a hybrid multi-criteria decision aid method for information systems outsourcing." Computers and Operations Research, vol. 34, No. 12, pp. 3691-3700.

Willcocks, L., Lacity, M., and Cullen, S. (2007) "Information technology Sourcing Research: Critique, Lessons and Prospects"

Yang, C. and J-B. Huang (2000) "A Decision Model for IS Outsourcing." International Journal of Information Management, Vol. 20, Iss.3, pp. 225-239.

Yu, P.L. and Y.C. Chen, (2005). "Empowering Analytic Hierarchy Process by Habitual Domain Concepts." Proceedings of the 8th ISAHP