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Strategic Alignment and IT Investment Selection Using the Analytic Network Process

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Abstract

It has been argued that the reason many organizations fail to fully realize the benefits of investments in information technologies is because of a lack of alignment between corporate and IT strategies. This is further complicated with the difficulty of aligning IT investment decisions with IT strategies. In this paper we present a proposed model to support the alignment of strategies to investment decisions. This model is presented as a hierarchical model implemented through the Analytic Network Process, a mathematical multi-attribute approach for decision making that allows for the transformation of qualitative judgements into quantitative values.

Introduction

It has been argued that the reason many organizations fail to fully realize the benefits of investments in information technologies (IT) is because of a lack of alignment between corporate and IT strategies. The Strategic Alignment Model (SAM) has been widely discussed as a model that assists in aligning corporate strategies to information technology decisions. While literature reports that the model has been successfully applied, there still exists the need to align decisions in these areas to investment decisions. This problem is basically one of aligning IT investment decisions with business strategies.

This paper discusses the application of Analytic Network Process (ANP) as a tool for aligning strategy to investment decisions. ANP is a multi-attribute approach for decision making that allows for the transformation of qualitative judgements into quantitative values and for the performance of analysis on these values. The ANP is a relatively simple, intuitive approach that can be accepted by managers and other decision-makers. The paper first reviews strategic alignment and its importance in realizing benefits from IT investments. After a brief review of ANP, a multi-attribute selection framework is developed and an ANP model is presented. The focus of this paper will be on the model itself, and not on the mathematical aspects of ANP.

Strategic Alignment

The Strategic Alignment Model, developed by Henderson and Venkatraman (1993), discusses the linkages of the four domains of business strategy, IT strategy, organizational infrastructures and processes, and IT infrastructure and processes (figure 1). Because these domains are interrelated, the structure and decisions made in any domain will affect the other domains. Multi-domain relationships can be defined and related to IT planning methods. Henderson and Venkatraman discuss four three domain perspectives for IT planning, each having a domain anchor and pivot. *Strategy implementation* uses the strategy domain as its anchor and assesses the implications of implementing these strategies through first organizational infrastructures and then through IT infrastructures. *Technology exploitation* begins with an analysis of IT strategy and its ability to influence business strategy and then implementing corresponding decisions about organization infrastructure. *Technology leverage* begins with business strategy and attempts to implement these strategies through development of appropriate IT strategies. These are in turn implemented through IT infrastructure decisions. Finally, *Technology Implementation* looks at the strategic fit between its anchor of IT strategy and the internal implementation of IT infrastructures which then influence the organization infrastructure. It is proposed the linkage of business and IT strategies are facilitated through these perspectives.

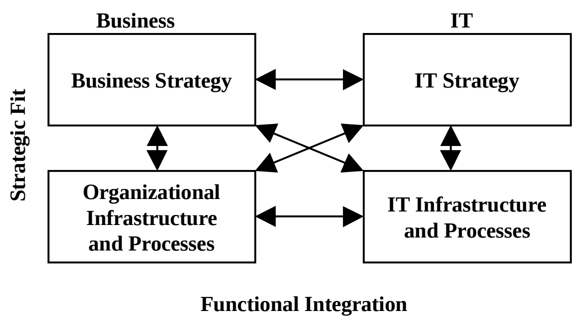

Figure 1. Strategic Alignment Model
Adapted from (Henderson & Venkatraman, 1994)

Analytic Network Process

The Analytic Hierarchy Process (AHP) for decision structuring and decision analysis was first introduced by Saaty (1980). AHP allows a set of complex issues that have an impact on an overall objective to be compared with the importance of each issue relative to its impact on the solution of the problem. Harker and Vargas (1987) states that "AHP is a comprehensive framework which is designed to cope with the intuitive, the rational, and the irrational when we make multi-objective, multi-criterion and multi-actor decisions with and without certainty for any number of alternatives." While AHP is conceptually easy to use, it is decisionally robust so that it can handle the complexities of real world problems (Saaty 1983). AHP models a decision-making framework that assumes a unidirectional hierarchical relationship among decision levels. The top element of the hierarchy (apex) is the overall goal for the decision model. The hierarchy decomposes to a more specific attribute until a level of manageable decision criteria is met. The hierarchy is a type of system where one group of entities influences another set of entities. Since the introduction of AHP, numerous applications have been published in literature.

The Analytic Network Process (ANP) is a general form of the AHP. Whereas AHP models a decision making framework that assumes a unidirectional hierarchical relationship among decision levels, ANP allows for more complex interrelationships among the decision levels and attributes. Typically, in AHP the top element of the hierarchy is the overall goal for the decision model. The hierarchy decomposes from the general to a more specific attribute until a level of manageable decision criteria is met. ANP does not require this strictly hierarchical structure. Two-way arrows (or arcs) represent interdependencies among attributes and attribute levels among levels, or if within the same level of analysis, a looped arc is used. The directions of the arcs signify dependence - arcs emanate from an attribute to other attributes that may influence it. The relative importance or strength of the impacts on a given element is measured on a ratio scale similar to AHP. A priority vector may be determined by asking the decision maker for a numerical weight directly, but there may be less consistency, since part of the process of decomposing the hierarchy is to provide better definitions of higher level attributes.

ANP Model for Strategic Alignment

In this section we present the preliminary ANP model for strategic alignment. This model uses the SAM as a framework and implements it in the partially hierarchical structure of ANP. We propose that ANP has promise with its ability to support bi-directional relationships such as those represented in the SAM. We also use as a supporting framework the work of Tallon and Kraemer (1998), who consider strategic alignment under two headings. Strategy shortfall occurs when an organization fails to take advantage of its existing IT capabilities. Technology shortfall results when an organization's information technologies do not adequately support its strategies. They define strategic alignment as the extent to which IT strategy supports, and is supported by the business strategy. Again, we have a bi-directional influence that can be represented through ANP.

The goal of the current phase of research is to develop a generic ANP model. A preliminary model is presented in figure 2. The named rectangles represent decision levels, clusters, or elements. The higher the level, the more "strategic" the decision. The topmost elements are decomposed into sub-components and attributes. The model begins with *Firm Performance* as the top level element. The complete model development will require the development of attributes at each level and a definition of their relationships. The arrows represent the direction of influence of one decision level on another where this influence represents dominance or control over another set of sub-components or attributes. In the model, two way arrows are used to represent interdependencies where influence can occur in both directions. For example, in figure 2, the bi-directional arrows between *Business Strategies* and *IT Strategies* reflects the situation where the development of IT strategies must be done within the context of business strategies but that the development of the business strategies can not be accomplished without consideration of IT strategies. Similarly, IT infrastructure decisions are made within the context of IT strategies which can not be made without regard to current IT capabilities as reflected in existing infrastructures and organization capabilities. The arrows that loop back into level from which it emanates are used to represent interactions within the level such as the case where one strategy would impact other strategies. In this case it might also be used to represent the interaction within the domains in SAM, such as the interaction of *Business Scope*, *Distinct Competencies*, and *Business Governance* within the *Business Strategy* domain (Henderson and Venkatraman 1993). The ANP approach could theroreti-

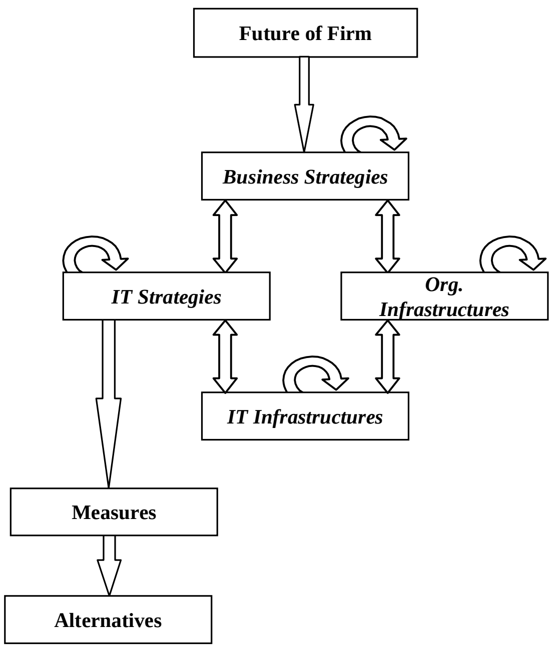

Figure 2. Generic ANP Model

cally be adapted to take into account any inter- or intra-domain relationship, although the number of relationships considered would necessarily increase the number of pairwise comparisons and calculations required. For example the twelve alignment perspectives identified by Luftman, Papp, and Brier (1999) could be used in combination. There would be some comparisons that would yield more relevant analysis than others.

The ultimate goal of model is to support the selection of IT investments through the development of criteria for assessing the impact of investment alternatives. Weights would be developed for the selection criteria and for the ability of alternatives to support or impact these criteria. Scoring models are well known in IT selection of investments, especially as a way to incorporate qualitative criteria with more traditional quantitative measures of impact. The ANP model will add rigor to the development of the weights. Also, the explicit consideration of relationships between decision levels and the use of pairwise comparisons in determining weighting of attributes helps ensure alignment of strategies to operating decisions. The measures are considered under the IT strategies since selection criteria for IT investments would be most strongly related to IT strategies. However, the ANP model with its interactions ensures we consider the influence of the other three levels.

While this proposed generic model is robust, its use in its fully defined form would be impractical. Pairwise comparisons are required for every element of a bi-level or inter-level interaction. Especially when bi-directional interactions are considered, the number of matrices and relationships required rapidly becomes too large to complete in a reasonable time period. Our goal is to validate the generic model and then adapt or instantiate the model for particular applications. This instantiation of the generic model can occur on at least two levels. First the instantiation could be used to represent one of the four three-domain relationships discussed earlier. For example, to illustrate the T*echnology Leverage* planning method, we would consider the decision levels of business strategy, IT strategies and IT infrastructures. There would be options for implementing this model, in that the level of interdependence to be represented in the model could be adjusted to fit the needs of the particular application. The example shown in figure 3 shows an application of the ANP model in which the model has been simplified to represent one level of interdependence, between *IT Strategies* and *IT Infrastructures*. This model would supports the *Technology Leverage* method's use of the *Business Strategies* as anchor and the use of the *IT Strategies* as a pivot. The second form of instantiation could occur outside of the planning method in which a company would develop a model by determining which of the elements are of interest to the company.

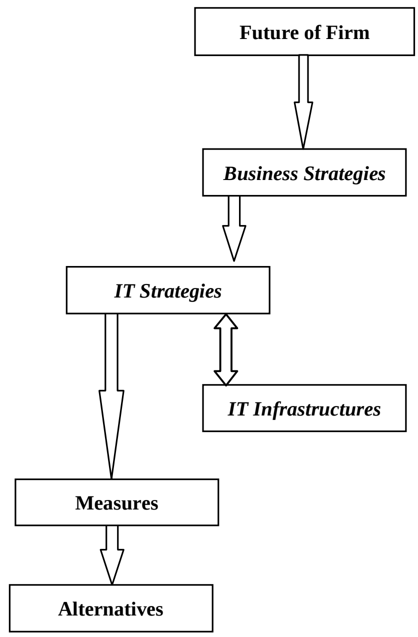

Figure 3. Model for Technology Leverage

Conclusion and Future Directions

ANP is a robust decision tool for decision-making across multiple criteria. It has been used in many applications across many fields. The imposition of a structure, such as the Strategic Alignment Model shows promise in adding rigor and validity to IT investment decisions. The research is still in its early stages. To date, a preliminary generic model has been developed. Future work includes validating the model through expert review, defining generic classes of elements within each level, and then applying an instantiation of the model at an organization. Lessons learned from these experiences will be incorporated into a final model.

References

References available upon request from the first author at apresley@truman.edu.