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Abstract Title: Selection of service supply chain value creating perspective using AHP approach

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Abstract

Analytic hierarchy process (AHP) based decision model presented in this paper structures the problem related to selection of service supply chain perspective in a hierarchical form with alternatives available to the decision maker. AHP is a suitable approach for undertaking quantitative as well as qualitative analysis. The approach differs from other multi-criteria as subjective judgments are readily included and the relevant inconsistencies are dealt with appropriately. The final outcome of the AHP is an optimum choice among decision alternatives. Thus, AHP based approach proposed in this paper provides a more realistic and accurate representation of the problem for selecting the service supply chain value creating perspective.

Keywords: Supply chain (SC); Service Supply Chain; Analytic hierarchy process (AHP); Multi-criteria decision making (MCDM), retail.

1. Introduction

Service comprise of activities, deeds and performance (Berry and Parasuraman, 1993; Zeithamal et al., 2006). In the newer and broader sense, service "is the application of competences for the benefits of another party" and such competencies could be manifested within a service supply chain (Vargo and Lusch, 2008). This logic embraces the concept of value co-creation between the customer and the supply chain for benefits (Ng et al., 2008; Payne et al., 2008; Prahlad and Ramaswamy, 2003). Therefore, service supply chain needs to be evaluated based on not only customer contact model (Chase and Apte, 2007), customer interactions (Johnson et al., 2005) and value co-production with the customer (Ramirez, 1999); but from the broader sense of the word 'customer'. Hence, it is very important that appropriate service supply chain value creating perspective should be chosen.

An evaluation framework, which incorporates determinants and alternatives of service supply chain system, would be useful in selecting appropriate service supply chain value creating perspective. One such approach, with an application of a systemic analysis technique is presented in this paper. This technique evaluates the various determinants of service supply chain value creating perspective through an analytic hierarchy process (AHP) model.

There are a number of variables affecting the selection of service supply chain value creating perspective. Analytic Hierarchy Process (AHP) is one of the analytical tools, which can be used to handle a multi-criteria decision-making problem (Saaty,1980).

The AHP model presented in this paper structures the problem related to selection of a service supply chain value creating perspective in a hierarchical form. One of the important issues for any strategic planning would be how the organization should prioritize the determinants and what policy elements or initiatives impact them (Wheelwright, 1978). Section 2 provides a brief discussion of determinants followed by section 3 which discusses the decision alternatives. These characteristics are then used to structure the model. Later, the proposed methodology for evaluating the decision model is presented and applied to a decision-making problem faced by a retail supply chain. This is followed by a discussion and managerial implications of this research. Finally, we conclude the work with the limitations of this work and directions for further research.

2. Determinants of service supply chain value creating perspective

After review of literature and discussion with six experts, three from academia and three from industry, some of the important determinants of service supply chain value creating perspective are identified. These four determinants are namely customer, people, information and technology. These are briefly described below:

2.1. Customer

The customer contributes information, knowledge, skills, and other resources that facilitate in shaping the value proposition. Thus, the customer is not only beneficiary of value but also a proposer of value. Hence, the customer becomes a partner in the distribution of the solution (Mele and Polese, 2011).

2.2 People

People (including employees and other stakeholders) define and develop value-creation process by exchanging and integrating resources (internal and external). Thus, co-creating experiences and strengthening relationships (Mele and Polese, 2011).

2.3 Information

Information act as major input and enabler in the value-creation process. Shared information enables customer and people to understand their needs, resources, and competencies. This facilitates the identification of the best pattern for creating value from the stakeholder perspective (Mele and Polese, 2011).

2.4 Technology

Technology facilitates the information-sharing across the stakeholders without the constraints of time, place, and space. It facilitates value-creation process by organizing data and information, and creating and using knowledge at the individual, team, organizational and supply chain level (Mele and Polese, 2011).

3. Alternatives for the service supply chain value creating perspective

After review of literature and discussion with six experts, three from academia and three from industry, some of the important service supply chain value creating perspectives are identified. .

These alternatives are supplier-centric, customer-centric, stakeholder-centric and balanced – centric (Mele and Polese, 2011). A brief description of all the four alternatives is given below:

3.1. Supplier-centric

In supplier-centric perspective, value is perceived in terms of what the supplier gets from the customer. Thus, supplier is the value builder and customer is the user who functions outside the value chain. The content of value in this perspective consists of "value-in-exchange" (Mele and Polese, 2011).

3.2. Customer-centric

In customer-centric perspective, value is perceived in terms of what the customer gets from the purchase. Here, customer plays an active part in the value-creation process. The content of value in this perspective consists of "value-in-use" (Mele and Polese, 2011).

3.3. Stakeholder-centric

In stakeholder-centric perspective, value is perceived in terms of what the stakeholder co-create. Here, value creation occurs within a network of relationships among many actors. The content of value in this perspective consists of "value-in-experience", as resources are shared and exchanged by all actors to achieve certain aims (Mele and Polese, 2011).

3.4. Balanced-centric

In balanced-centric perspective, value is perceived in terms of what the stakeholder co-create and gets from the co-creation. Here, relationship among the stakeholders suggests the deepening of network as powerful concept. The content of value in this perspective consists of "value-in-experience", as resources are shared and exchanged by all actors to achieve certain aims and in return expect something for themselves (Mele and Polese, 2011).

4. The decision environment

A graphical representation of the AHP model and decision environment is shown in Figure1

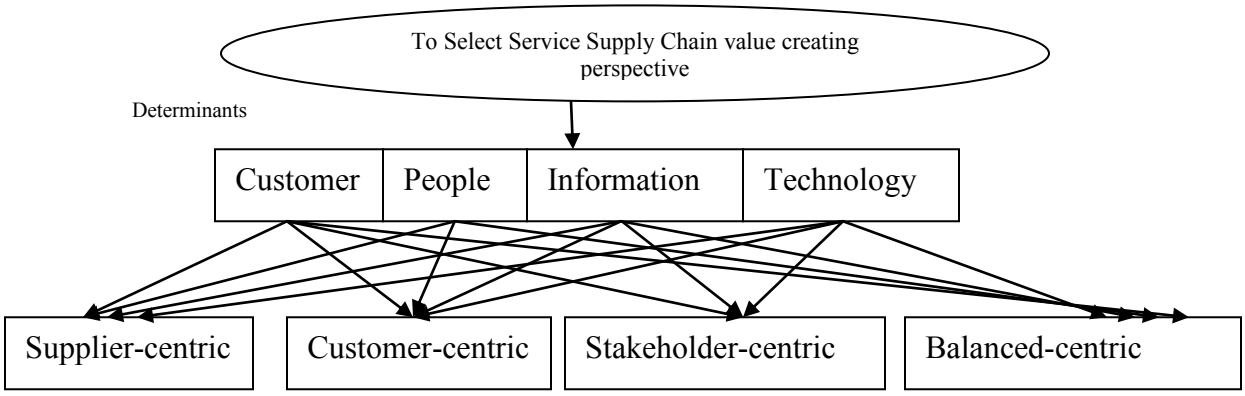

Figure 1: AHP-based framework for Selecting Service Supply Chain Value Creating Perspective

It can be seen that the overall objective is to select Service Supply Chain Value Creating Perspective in the retail industry. The determinants for selecting Service Supply Chain Value Creating Perspective are described in Section 2. The alternatives in this model are the specific service supply chain value creating perspective that a decision maker wishes to evaluate, given the various attribute levels of the Service Supply Chain Value Creating Perspective. The various alternatives available to the decision maker in this example include Supplier-centric, Customer-centric, Stakeholder-centric and Balanced-centric. In Section 5, we briefly describe analytical hierarchy process and in section 6, apply it to industry to explain the AHP methodology.

5. Analytic hierarchy process

AHP (Saaty, 1980) is a multi-criteria decision-making technique. One of the main advantages of this method is the relative ease with which it handles multiple criteria. In addition to this, AHP is easier to understand and it can effectively handle both qualitative and quantitative data. The use of AHP does not involve cumbersome mathematics. AHP involves the principles of decomposition, pairwise comparisons, and priority vector generation and synthesis.

5.1. AHP as a qualitative tool

AHP is a multi-attribute, decision-making approach based on the reasoning, knowledge, and experience of the experts in the field. AHP can act as a valuable aid for decision making involving both tangible as well as intangible attributes that are associated with the model under study. AHP relies on the process of eliciting managerial inputs, thus allowing for a structured communication among decision makers. Thus, it can act as a qualitative tool for strategic decision-making problems. Philip-Wren et al. (2004) used AHP model for evaluation of decision support system. Similarly, Wei et al. (2005) used AHP model for ERP system selection.

5.2. Advantages of AHP

AHP is a suitable approach for undertaking quantitative as well as qualitative analysis (Saaty, 1980). The approach differs from other multi-criteria as subjective judgments are readily included and the relevant inconsistencies are dealt with appropriately (Hafeez et al., 2002). The final outcome of the AHP is an optimum choice among decision alternatives. Partovi et al. (1990) outlines the following benefits of using AHP:

(a) it formalizes and makes systematic what is largely a subjective decision process and thereby facilitates "accurate" judgments;

(b) as a by-product of the method, management receives information about the evaluation of the cost drivers' and activities' implicit weights; and

(c) the use of computers makes it possible to conduct sensitivity analysis on the results.

Another advantage of using AHP as stated by Harker and Vargas (1987) is that it results in better communication, leading to clearer understanding and consensus among decision makers groups, and hence a greater commitment to the chosen decision.

5.3. Limitations of AHP

Identifying the relevant attributes of the problem and determining their relative importance in decision-making process requires extensive discussion and brainstorming sessions. It requires calculations and formation pair-wise comparison matrices, thus, a careful track of matrices and pair-wise comparisons of attributes is necessary.

The pair-wise comparison of attributes under consideration can only be subjectively performed, and hence their accuracy of the results depends on the user's expertise knowledge in the area concerned.

AHP models a decision-making framework that assumes uni-directional hierarchical relationship among decision levels. This feature makes it inferior to ANP which can capture interdependencies among different enablers, criteria, and sub-criteria (Agarwal and Shankar, 2003).

6. An example of retail supply chain

The AHP model that is presented in this research has been evaluated in a retail supply chain, which was interested in the finding its service supply chain value creating perspective. The organization wanted a systematic way to determine its service supply chain value creating perspective. The case experience helps us to understand in a better way the advantages and disadvantages of the methodology from a practical point of view. The analysis and the implementation of the AHP model are presented in the following steps.

Step1: Model development and problem formulation

In this step, the decision problem is structured into its important components. The relevant determinants and alternatives are chosen on the basis of the review of literature and discussion with six experts both from industry and academia. The relevant determinants and alternatives are

structured in the form of a hierarchy where the determinants at the top level in the model have the highest strategic value. The top-level determinants in this model are customer, people, information and technology.

The objective of this hierarchy is to select the service supply chain value creating perspective in the present case. The AHP model so developed is presented in figure 1. The alternatives that the decision maker wishes to evaluate are shown at the bottom of the model.

The opinion of the experts from the case service supply chain was sought in the comparisons of the relative importance of the criteria and the formation of pair-wise comparison matrices to be used in the AHP model. The results of all the four determinants would be used in the calculation of service supply chain value creating perspective score (SSCVCPS), which indicates the score assigned to a service supply chain value creating perspective.

Step 2: Pair-wise comparison of six determinants

In this step, experts were asked to respond to a series of pair-wise comparisons where two components at a time are compared with respect to an upper level 'control' criterion. These comparisons are made so as to establish the relative importance of determinants in achieving the case company's objectives. In such comparisons, a scale of 1–9 is used to compare two options (Saaty, 1980). In this a score of 1 indicates that the two options under comparison have equal importance, while a score of 9 indicates the overwhelming dominance of the component under consideration (row component) over the comparison component (column component) in a pair-wise comparison matrix. In case, a component has weaker impact than its comparison component, the range of the scores will be from 1 to 1/9, where 1 indicates indifference and 1/9 represents an overwhelming dominance by a column element over the row element. For the reverse comparison between the components already compared, a reciprocal value is

automatically assigned within the matrix, so that in a matrix $a_{ij}a_{ji} = 1$. The matrix showing pair-wise comparison of determinants along with the e-vectors of these determinants is shown in Table 1.

Table 1: Pair-wise comparison of determinants [Consistency ratio (CR): 0.03]

Determinants	Customer	People	Information	Technology	e-vector
Customer	1	5	3	3	**0.527**
People	1/5	1	1	1/3	**0.102**
Information	1/3	1	1	1/2	**0.129**
Technology	1/3	3	2	1	**0.241**

The e-vectors (also referred to as local priority vector) are the weighted priorities of the determinants and shown in the last column of the matrix. In this paper, a two-stage algorithm (Saaty, 1980) is used for computing e-vector. For the computation of the e-vector, we first add the values in each column of the matrix. Then, dividing each entry in each column by the total of that column, the normalized matrix is obtained which permits the meaningful comparison among elements. Finally, averaging over the rows is performed to obtain the e-vectors. These e-vectors would be used in Table 6 for the calculation of service supply chain value creating perspective score (SSCVCPS) for alternatives.

Step 3: Evaluation of alternatives

The final set of pair-wise comparisons is made for the relative impact of each of the alternatives (supplier-centric, customer-centric, stakeholder-centric and balanced–centric) on the Determinant's. The number of such pair-wise comparison matrices is dependent on the number of the determinants. In present case, there are 4 determinants, which lead to 4 such pair-wise matrices; which are shown in Table 2-5.

Table 2: Matrix for alternatives' impact on determinants Customer (C) [Consistency ratio = 0.09]

Customer	supplier-centric	customer-centric	stakeholder-centric	balanced–centric	e-vector
supplier-centric	1	1/3	5	7	**0.311**
customer-centric	3	1	5	7	**0.544**
stakeholder-centric	1/5	1/5	1	3	**0.097**
balanced–centric	1/7	1/7	1/3	1	**0.048**

Table 3: Matrix for alternatives' impact on determinants People (P) [CR=0.02]

People	supplier-centric	customer-centric	stakeholder-centric	balanced–centric	e-vector
supplier-centric	1	1/3	1/5	½	**0.090**
customer-centric	3	1	1	3	**0.362**
stakeholder-centric	5	1	1	3	**0.406**
balanced–centric	2	1/3	1/3	1	**0.143**

Table 4: Matrix for alternatives' impact on determinants Information (I)[CR =0.10]

Information	supplier-centric	customer-centric	stakeholder-centric	balanced–centric	e-vector
supplier-centric	1	2	3	3	**0.433**
customer-centric	½	1	3	2	**0.289**
stakeholder-centric	1/3	1/3	1	3	**0.172**
balanced–centric	1/3	½	1/3	1	**0.106**

Table 5: Matrix for alternatives' impact on determinants Technology (T) [CR =0.04]

Technology	supplier-centric	customer-centric	stakeholder-centric	balanced–centric	e-vector
supplier-centric	1	1/3	2	3	**0.238**
customer-centric	3	1	3	5	**0.517**
stakeholder-centric	½	1/3	1	3	**0.168**
balanced–centric	1/3	1/5	1/3	1	**0.077**

Step 4: Calculation of service supply chain value creating perspective score (SSCVCPS)

The SSCVCPS for an alternative i ($SSCVCPS_i$) is the summation of the products of the relative importance weights of the alternative (A_{ia}) and the relative importance weights of the determinants (D_a) of the service supply chain value creating perspective. It is represented as:

$$SSCVCPS_i = \Sigma A_{ia} D_a$$

For example, the SSCVCPS for customer-centric is calculated as:

$SSCVCPS_{\text{Customer-centric}}$ = [(0.527 X 0.544) + (0.102 X 0.362) + (0.129 X 0.289)

+ (0.241 X 0.517)]

= 0.476

The final results are shown in Table 6.

Table 6: Weightages of determinants for SSCVCP alternatives

	supplier-centric	**customer-centric**	**stakeholder-centric**	**balanced–centric**
Customer (0.527)	0.311	0.544	0.097	0.048
People (0.102)	0.090	0.362	0.406	0.143
Information (0.129)	0.433	0.289	0.172	0.106
Technology (0.241)	0.238	0.517	0.168	0.077
Score of Alternatives (SSCVCPS)	**0.284**	**0.476**	**0.164**	**0.076**

It is observed from Table 6 that the case retail chain has a customer-centric service supply chain value creation perspective. Supplier-centric, stakeholder-centric and balanced-centric follow this alternative. It is observed from Table 1 that customer is the most important determinant which

the case supply chain considers. These results should be seen in the light of the characteristics of the case supply chain and the inputs provided by the experts in the pair-wise comparison.

7. Discussion and managerial implications

In this section, we first discuss the results of the model. Later, we present few suggestions to the prospective users of this model. Finally, we discuss the managerial implications of this model and some generalization of results.

The major contribution of this research lies in the development of a comprehensive model, which incorporates diversified issues for selecting, finding and evaluating its service supply chain value creating perspective. The proposed AHP model in this paper, not only guides the decision makers in the evaluation of the service supply chain value creating perspective but also enable them to visualize the impact of various criteria in the arrival of the final solution.

For the case undertaken in this study, the results indicate that customer-centric perspective is the top most emphasis of the case supply chain, which is followed by supplier-centric, stakeholder-centric and balanced-centric perspectives. The choice of the case supply chain towards customer-centric perspective may be attributed to the fact that it emphasis is on “value-in-use”. It is relevant to discuss here the priority values of the criteria of service supply chain value creating perspective, which influence this decision. From Table 1, it is seen that customer (Ca = 0.527) is the most important criteria for the case service supply chain. Technology (0.241), information (0.129) and people (0.102) follow it. Supply chain focus has forced the companies to look beyond their own companies and towards supply chain in a holistic way. Therefore, the case supply chain should change it emphasis from customer-centric to stakeholder-centric perspective.

Table 6 shows the SSCVCPS for the alternatives. It is observed from the table, that customer-centric perspective excels over the other three alternatives in the case supply chain. Though, in the illustrated example, the model has been described for four distinct alternatives, it can accommodate more than four at the cost of complexity. In the light of the results obtained for the case company, it is to be noted that the results obtained are valid for the case supply chain in its own decision environment. It is the decision environment of the user, which makes one alternative superior to other.

Though the proposed AHP model is based on a sound algorithm for systemic decision-making, care must be taken in its application, the reason being that the user has to compare the service supply chain value creating perspective on a number of pair-wise comparison matrices. The determinants and dimensions identified in the proposed model are quite generic and with marginal adjustments can be used for different sector also.

8. Conclusion

Implementation of service supply chain value creating perspective may cost in millions of dollars for company. And implementation of these may be a risky endeavour for the top management as it involves financial and operational aspects, which can determine the performance of the company in the long run. And since nowadays companies compete against each other through their supply chains. So the question now is not whether to go for it or not, but which perspective to pick up. This research is relevant in this sense. The AHP model presented in this paper structured the problem of evaluation of service supply chain value creating perspective in a hierarchical form and linked the determinants and the alternatives available to the decision maker.

Thus, an AHP approach proposed in this paper can provide to the decision maker a more realistic and accurate representation of the problem for evaluation of service supply chain value creating perspective. This study aids the decision makers in the complex task of prioritizing their options. The utility of the AHP methodology in integrating both quantitative as well as the qualitative characteristics, which need the attention of the decision maker in arriving at the appropriate possible solution, assumes tremendous value.

The model developed in this paper has a few limitations as well. The formation of the pair-wise comparison matrices and data acquisition is a tedious and time-consuming task. Also, more importantly, the results reported in this research are based on the opinion of the experts from the case company. Thus, the pair-wise comparison of the criteria always depends on the user's knowledge and familiarity with the firm, its operations, and its industry. Therefore, the biasing of the experts to some criteria might have influenced the results. Although, we have tried to minimize this by checking the consistency of comparison using method of consistency-ratio check as suggested by Saaty (1980). Consistency ratio (CR) is calculated for all the pair-wise comparisons to check the inconsistency in decision-making. In the proposed model CR varies from 0.001 to 0.11, which is within tolerable limit (Saaty and Kearns, 1985). Hence, the identification of the relevant attributes to the problem under consideration, the determination of their relative importance in comparison to others require extensive brainstorming sessions, and the accumulation of expertise and knowledge within the organization. Since many of the issues in the pair-wise comparisons are cross functional in nature, a team of managers from various functional departments should be assigned the responsibility of comparison. Delphi method may also be a promising technique that may be explored in this regard.

A possible extension of this research study might be to study the preferences of the user companies corresponding to different sizes and sectors, where these determinants may be modeled as per the choice of companies. The model may also be subjected to sensitivity analysis. User-friendly software may also be developed on the basis of the model.

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