World Applied Sciences Journal 27 (7): 840-844, 2013
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2013.27.07.13690

Using Expected Utility Criterion for Choosing Strategies of Interaction of University with Stakeholders

Konstantin Sergeevich Solodukhin and Aleksandr Aleksandrovich Gresko

Vladivostok State University of Economics and Service,
Gogolya Street, 41, 690014, Vladivostok, Russia

Submitted: Nov 10, 2013; **Accepted:** Dec 13, 2013; **Published:** Dec 16, 2013

Abstract: We propose to choose the most appropriate strategy of interaction of university with different stakeholders in the conditions of uncertainty (risk) on the base of criterion of expected utility. Making decision on which type of strategy must be chosen for interaction with every group of stakeholders is based on the calculated deterministic equivalents for every type of strategy of interaction. The advantage of such approach is taking into consideration risk incurred by the decision-maker. In the article a way to build empirical curve of equivalents and algorithm of identification of the deterministic equivalents of strategy types are described and illustrated by use of an example.

Key words: Stakeholders · Interaction strategies · Deterministic equivalent · Criterion of expected utility

INTRODUCTION

By now many universities have accumulated considerable experience of use of strategic management methods and models. Some universities in their activity use specially developed methods of strategic management based on the stakeholder concept [1].

The origination of stakeholder theory dates back to widely recognizable and often cited work of R. Freeman "Strategic management: a stakeholder approach" in which the notion "stakeholder" has a new meaning, the author defines this meaning and proposes unique model of corporation (firm) [2]. In stakeholder concept company's operations depend on wide range of interested parties (stakeholders) (consumers, suppliers, shareholders, managers, employees etc) and every stakeholder is chasing his own interests and has some rights of control over the company. The concept suggests decision-making based on the necessity to satisfy multiple and often conflicting with each other demands from these stakeholders.

Idea that a company must use different strategies while interacting with different interested parties and moreover, even different strategies in regard to the same party in different periods of time is not new [3]. The authors of this article suggest that at different stages of company's life cycle different resources are needed, therefore relative importance of every group of stakeholders will be different too. And interaction strategy to deal with this party will change as well. As a result at every stage of life cycle (birth, growth, maturity, rebirth) an attempt is made to correlate with every significant stakeholder one of the 4 strategies: reaction, protection, adjustment and pro-activity, proposed by A. Carroll [6].

In the works [1, 7] another set of strategies of a university's interaction with stakeholders was proposed: answering requests, protection, impact, cooperation. Here, in its contents the strategy of answering to requests is similar to the proactive strategy and strategy of protection is similar to the strategy of adjustment. In the same time the strategies of protection and reaction in Carroll's opinion can not be regarded as interaction strategies to deal with stakeholders because they suggest ignoring interests of stakeholders (and even the fight against them for reaction strategy) except for fulfilling only least portion provided by laws (for protection strategy). Following these two strategies in fact means that company does not follow stakeholder management as discrete institutional alternative.

Corresponding Author: Solodukhin, Vladivostok State University of Economics and Service, Gogolya Street, 41, 690014, Vladivostok, Russia.

Besides that 4 types of Carroll's strategy are reactive strategies (while proposed by us strategies of cooperation and impact are pro-active). Hence I. Jawahar and G. MacLaughlin while recommending that or this strategy of interaction with the given group of stakeholders do not tie-up this choice with company's opportunities to follow this strategy (possession by the company of appropriate competences) or with already formed relations between this organization and stakeholders group (mutual expectations, wish to change relations from both sides, degree of mutual influence in the framework of existing structure of formal and non-formal institutions). It is also worth mentioning the possible difficulties with identification of the life cycle stage for some companies, including university.

While interacting with a group of stakeholders a company is striving for long-term balance of relations which depends on the most appropriate range of interaction strategies. The choice of some type of interaction strategy by a company to deal with specific group of stakeholders is determined on the one hand by the results of assessment, by the company, of established relations and opportunities of their changing [7], on the other hand - by degree of development of appropriate competences by a company (availability of key competences), necessary for realization of every possible strategy types [8].

The work [9] offers the method of scenario analysis for evaluation of relationship between university and its stakeholders with due regard to the relationship between stakeholder groups, where at the 4th stage the calculation and analysis of weights (weight coefficients) of appropriateness of application of interaction strategy types were made. The problem of choice of the most appropriate set of strategies of interaction with stakeholders was not completely solved and decision-maker (DM) was supposed to choose the type of strategy on the base of calculated or taken separately values of mathematical expectation and variance.

The authors of the work [10] propose to solve the problem of choice of the most appropriate interaction strategy by use of generalized criterion, which combines mathematical expectation and variance. Proposed method allows to identify and range Pareto-optimal set of strategy types and define the limits of risks for DM. But this method has a number of disadvantages, the key disadvantage is as follows: generalized criterion is based on assumption of constant risk aversion measure of DM.

This work proposes one more method of choice of university and stakeholders interaction strategies based on utility function.

Main Part: For every scenario of stakeholders' interaction with each other [9] weights (weight coefficients) can be found which determine appropriateness (utility) of use of different strategy types. The choice of proper type is made on the base of analysis of relationship's characteristics. This analysis of relationship between a university and a certain group of stakeholders can demonstrate the availability of several possible situations; for every situation a certain (the most appropriate) type of strategy can be used: answering requests, protection, impact or cooperation. In order to determine which strategy must be used in regard to a specific group of stakeholders in a given situation every strategy is assigned with appropriate weight corresponding to the appropriateness of its use [1].

Every coefficient is a value of some function, arguments of which are some characteristics of relationship and range of function is between 0 and 1. Here every function must take maximal value if appropriate characteristics of relationship reach their marginal values for every specific case.

Weight coefficients $w_i^k (i = \overline{1,4})$ showing appropriateness of use in regard to *k* group of stakeholders of the strategy of *i*-type can be calculated by formulas:

$$w_1^k = \frac{5 + G_1^k - V^k}{20},\ w_2^k = \frac{10 - \left|G_1^k - 5\right| - V^k}{15},\ w_3^k = \frac{5 + G_2^k + V^k}{20},\ w_4^k = \frac{25 - G_1^k - G_2^k - \left|V^k\right|}{25}, \quad (1)$$

where G_1^k, G_2^k are degrees of wish of changes from *k*-group of stakeholders in regard to university and from university in regard to *k*-group of stakeholders; V^k is a quantitative estimate of power between university and *k*-group of stakeholders.

Table 1: Appropriateness of use of strategy types by universities while interacting with customers.

	Types of interaction strategies			
Scenarios (probabilities)	Answering requests	Protection	Impact	Cooperation
Scenario 1 (0,3)	0,57	0,71	0,47	0,6
Scenario 2 (0,23)	0,71	0,43	0,61	0,43
Scenario 3 (0,18)	0,46	0,62	0,36	0,6
Scenario 4 (0,15)	0,54	0,72	0,44	0,5
Scenario 5 (0,09)	0,5	0,67	0,4	0,63
Scenario 6 (0,05)	0,55	0,73	0,45	0,56

We are going to consider working example which was analyzed by the authors in the work [10] and decide which type of strategy must be used - and we shall use the criterion of expected utility.

Table 1 demonstrates appropriateness of use of strategy types of interaction of some university with a group of stakeholders "Customers" (they are consumers of educational and non-educational services of university).

First we introduce the parameters. We shall consider random parameter $\xi = \begin{bmatrix} x_1 \dots x_k \\ p_1 \dots p_k \end{bmatrix}$, where $p_i \geq 0, \sum_{i=1}^{k} p_i = 1$ as lottery with a win prizes $x_1,....,x_k$ where p_i is a portion of prizewinning tickets, $x_i (i = \overline{1,k})$. In our case as DM does not know in the framework of which scenario the relations with customers will be built we shall take interaction strategies for lotteries. X_i and p_i are appropriatenesses of application of strategy types and probabilities of scenarios accordingly.

Thus, we have 4 lotteries:

$$\xi_1 = \begin{bmatrix} 0,57 & 0,71 & 0,46 & 0,54 & 0,5 & 0,55 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}, \xi_2 = \begin{bmatrix} 0,71 & 0,43 & 0,62 & 0,72 & 0,67 & 0,73 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}, \xi_3 = \begin{bmatrix} 0,47 & 0,61 & 0,36 & 0,44 & 0,4 & 0,45 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix},$$
$$\xi_4 = \begin{bmatrix} 0,6 & 0,43 & 0,6 & 0,5 & 0,63 & 0,56 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}.$$

In order to choose the most appropriate type of interaction strategy it is necessary for every type of strategy (lottery) to define deterministic (non-probabilistic) equivalent (DE). DE is appropriateness of using this strategy type when we have absolutely possible scenario (p=1), which for DM is equal to choosing this type of strategy in conditions of uncertainty (when DM does not know which scenario of interaction between university and stakeholders group will be realized). It is supposed that the choice will be made in favor of such type of interaction strategy to which the highest DE will correspond.

In order to define DE of strategy type we can use the following algorithm [11].

Step 1: Build in accordance with given interaction strategy-type ξ the type of interaction strategy in utilities $u[\xi]$ To do that it is necessary in the type of interaction strategy ξ to change every appropriateness of use of this type of strategy x_i for its utility $u(x_i)$

Step 2: Find expected utility $E(u[\xi])$ of the interaction strategy type ξ by formula:

$$E(u[\xi]) = \sum_{i=1}^{k} p_i u(x_i) \tag{2}$$

Step 3: From the point $E(u[\xi])$ lying on y-axis move through the curve of equivalents to x-axis. The resulting point will be DE of interaction strategy type.

Let us build a curve of equivalents of interaction strategy type for the given example. Let us notice that appropriatenesses of use of interaction strategy types lie between 0.36 and 0.73 (the worst and the best value of appropriateness).

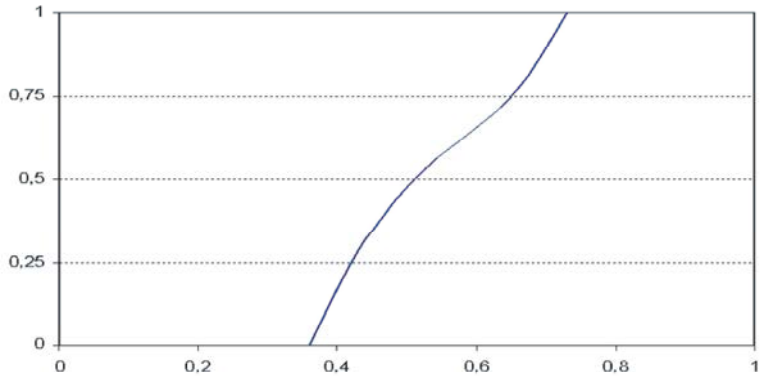

Fig. 1: Empirical curve of equivalents

In order to build this curve we have to find 5 points $(a;0),(A;1),(x_{0,25};0,25)$, $(x_{0,5};0,5)$, $(x_{0,75};0,75)$ the last 3 point will be identified by asking questions to DM. Here α - the worst value of appropriateness of interaction strategy type; A is the best; $a < x_{0,25} < x_{0,5} < x_{0,75} < A$.

Interview with DM is taking place in the following way. For example, for finding the point $(x_{0,5};0,5)$ DM is asked a question: "Which must be appropriateness of application of interaction strategy type with utility value of 0,5?" In the same way the questions are asked to find the points $(x_{0,25};0,25)$ and $(x_{0,75};0,75)$. After we have found 5 points we draw a smooth curve through them - empirical curve of equivalents (Figure 1).

Let us define step by step DE of every type of interaction strategy:

$$\text{Step 1.} u[\xi_1] \approx \begin{bmatrix} 0,6 & 0,87 & 0,37 & 0,55 & 0,45 & 0,57 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}, \; u[\xi_2] \approx \begin{bmatrix} 0,87 & 0,28 & 0,68 & 0,89 & 0,74 & 1 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix},$$

$$u[\xi_3] \approx \begin{bmatrix} 0,39 & 0,65 & 0 & 0,32 & 0,15 & 0,35 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}, \; u[\xi_4] \approx \begin{bmatrix} 0,64 & 0,28 & 0,64 & 0,45 & 0,69 & 0,58 \\ 0,3 & 0,23 & 0,18 & 0,15 & 0,09 & 0,05 \end{bmatrix}.$$

$$\text{Step 2. } E(u[\xi_1]) = 0,6 \cdot 0,3 + 0,87 \cdot 0,23 + 0,37 \cdot 0,18 + 0,55 \cdot 0,15 + 0,45 \cdot 0,09 + 0,57 \cdot 0,05 = 0,5982,$$

$$E(u[\xi_2]) = 0,6979, \; E(u[\xi_3]) = 0,3455, \; E(u[\xi_4]) = 0,5302.$$

$$\text{Step 3. } DE\ \xi_1 = u^{-1}(E(u[\xi_1])) = u^{-1}(0,5982) \approx 0,57, \; DE\xi_2 = u^{-1}(E(u[\xi_2])) = u^{-1}(0,6979) \approx 0,63,$$

$$DE\ \xi_3 = u^{-1}(E(u[\xi_3])) = u^{-1}(0,3455) \approx 0,46, \; DE\ \xi_4 = u^{-1}(E(u[\xi_4])) = u^{-1}(0,5302) \approx 0,54.$$

CONCLUSION

The highest DE was obtained for the strategy ξ_2 (protection strategy). Thus, if criterion of expected utility is applied this type of strategy of interaction is the most preferable. In this case the choice of the most preferable type of strategy based on the criterion of expected utility (judged by value of DE) coincides with the choice of the most preferable strategy type if we apply the criterion of expected gain (judged by the value of mathematical expectation). However in general case decisions about the choice of the most preferable type of strategy can be different. These two criteria differ from each other in the following way: decision based on the criterion of expected utility engages the attitude of DM to risk. Empirical curve of equivalents demonstrates it very well. In our case when appropriate strategy types lie in the range [0.36; 0.51] DM is not going to risk (utility function is convex); in the range [0.51; 0.73] DM is liable to risk (utility function is saddle-like) - see Figure 1.

Inference: The essence of this work is proposal to use the criterion of expected utility while choosing the most appropriate strategy types of interaction between university and different stakeholders in the conditions of uncertainty. The advantage of this method is taking into account the attitude of a decision-maker towards risk.

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