IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL)
ISSN (P): 2347–4564; ISSN (E): 2321–8878
Vol. 7, Issue 2, Feb 2019, 569–574

REAL TIME ANALYSIS OF SOFTWARE ASSESSMENT OF RECYCLING PRODUCTS

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Received:16 Feb 2019 **Accepted: 22 Feb 2019** **Published: 28 Feb 2019**

ABSTRACT

Generally the recycling process represents the last phase of developing process of any product. There is a need to analyze the recycle product in real time environment using the unique software for any recycling equipments. The developed software can be realized into seven hierarchical criteria and a mathematical model is proposed depending on the defined criteria. This paper discuss about market validation of recycled equipments with its software on real time basis. So a new model for market validation of device for recycling is proposed. Linguistic expressions are defined in this paper to find the values of the factors derived and thereby to solve any uncertainties in the event of analysis. These linguistic variables are modeled using Fuzzy logic i.e. triangular fuzzy numbers. The proposed fuzzy theorem on validation can be considered as reference for different recycled equipments and can formulate a benchmark for successful validation and marketing.

KEYWORDS: *Recycling, Uncertainty, Fuzzy Logic and Linguistic Expression*

INTRODUCTION

The competitiveness among the companies nowadays forces them to increase their profit constantly. In case of manufacturing companies unique simulation models are required to obtain both qualities of products as well as good validation of the products. In order to include effective engineering changes and to reduce process faults validation is essential [1]. But on the view of customer perception the validation play important role for any products. The validation is defined in [2] and [3] is a method that utilized the clear defined specifications and undergoes its purpose. The definition is fully focused on fulfilling an intended use or for any application. Depending on the market analyses, benchmarking tool, mathematical statistics, the market validation can be performed and justify the customer requirements. In this paper, primary is focused on the recycling equipment. Mainly uncertainties raises in factors designed, sub-factors and the customer satisfaction. In order to solve this, linguistic expressions can be used like fuzzy technology that solves uncertainty. Modeling of the linguistic terms is based on the fuzzy sets theory [4]. An ordinary reasoning methods used in Fuzzy set theory to approximate information and uncertainty. The obtained results give the solution to the uncertainty problem. In this paper, here triangular fuzzy sets are used for uncertainty. As describe in [5] fuzzy based decision making problem is used here to solve the uncertainty. The decision making by the management team or knowing the validation of product can be known from the mentioned fuzzy technique. The fuzzy approach is not a complicated mathematical exercise, but by employing it it can be easily capture and match the thinking style of humans. This approach is most widely used [6,7] for getting unique solution. Therefore utilizing the fuzzy models a software is proposed to get solve the defined problem. The next section describes the

evaluation framework, software for determining the market validation and finally conclusion.

Evaluation Framework

Real time assessment of any Recycling equipment should give always good efficiency, durability and should ensure environmental protection. So series of criteria should be analyzed for a good recycle equipment. Finally proper market validation has to be performed before product manufacturing. The assessment of market validation is a unique problem and in turn depends on the following criteria's.

Criteria 1: Here in this criteria cost and product quality is considered to assess the market validation of defined product. Generally, management team can be presented by index set E={1...e...E}, where e is the index for decision maker while E is the total number of decision makers of management team.

Criteria 2: The real time assessment software is defined into seven steps:

- Getting clear business strategy, competencies, business model and product concept
- How the product has to enter in toMarket
- Analyze the competiveness of the product and ensure its existence in the Market
- Detail about Buyers
- Key values for Buyers and possibly can be tested
- Knowing the market strategy
- Establish the marketing strategy correction for product positioning.

Criteria 3: In this criterion Let the factors which influence to market validation are identified by management team. Depending on the performance of the product the factors which are identified can be defined. The sub factors can be derived from identified main factors. Formally, factors and their sub-factors are presented by set indices I={1...i...I}, and, Ji = 1, …, j.,,, Ji, respectively. Let i and j be the factors and sub factors indices, respectively.

Criteria 4: Here in this criteria safety reduction parameters are considered and Fuzzy technique is employed with respect to defined parameters. The assessment is performed on the defined parameters and the defined problem and solution is by fuzzy group decision. The fuzzy pair-wise comparison matrix of the relative importance of factors is constructed. The values of the matrix are obtained by fuzzy technique. By using the extent analysis method in [1], the weights vector of each identified factors can be found.

Criteria 5: Here the sub factors are calculated. Generally all sub-factors are both quantitative and qualitative in nature. The values of quantitative factors are by crisp numbers. The qualitative factor values are assessment by management team.

Steps of Developed Software

In this Section, steps of the developed software are presented. The all steps are presented by GUI Screens (in further text only screens). Step 1. Defining the business strategy, competences, and business model and product concept. The information of this steps are: size of enterprise, annual profit, the share in total income from the new product income, number of employees on new product implementation, product's life cycle and investments in new product. The pieces of information of the second screen are: production capacity of full product, outsourcing potentials, development quality and

product quality. The third screen contains the following pieces of information: knowledge and skills of product development employees, knowledge and skills of ICT sector, knowledge and skills in marketing, team work knowledge and skills, production knowledge and skills Step 2. Cover the defining of the product context form market entry. The first screen of this step shows next pieces of information: product's name, price, capacity, reliability, competitiveness and selling rate. The second screen contains questions: Who, Why and Where buys. Step 3. Cover the identification of leader in this area and making the position with respect to him. Step 4. Cover the recognition of key values for a buyer. Key values for buyers are shown in Table 1. Step

Now considering the buyers point of view, the algorithm of proposed fuzzy model is given below.

Step 1: Calculation of aggregated values of the relative importance factor i, over factor ' i by using the fuzzy method:

$$W'n=\frac{1}{E}W_n^q.i, i=1....I$$
$$Wn=(x,l_n^q,m_n^q,u_n^q), i=1....I \quad (1)$$

In this paper, the fuzzy rating of each pair of considered factors is described by all decision makers.

Table 1: Factors And Sub Factors

Marketing Factor (I)	Factor of Safety And Servicing (I =3)	Factor Of Environmental Protection (I= 4)
Lead time to customer (j = 1)	Safety Level (j=1)	Level of Satisfaction demands of environmental (j = 2)
Rating and Market Production cost (j =2)	Maintainability (j=2)	Percentage of Materials not able to recycle(j=2)
Market entry velocity (j =3)	Possibility of using alternate product (j =3)	Reusability level (j=3)
Customer Satisfaction level (j =4)	Customer Satisfaction level (j =4)	Customer Satisfaction level (j =4)

Step 2: Now find the Pair Wise Comparison Matrix using fuzzy relating to the relative importance of the factors

$$\tilde{WF}=\left[\tilde{W}_{ii'}\right]_{kI}, i,i'=1,..,I; i\neq i' \quad (2)$$

Step 3: Now use Extend analysis and find the Weights thereby Weight vectors can be found.

$$W=(w_1,...,w_i,...,w_I) \quad (3)$$

Step 4: Find the normalized Weight values with respect ot sub factor can be found by applying the simple Normalization method

$$r_{ij}=\frac{v_{ij}}{t_{ij}^*}, \ j=1,..,J_i; i=1,..,I \quad (4)$$

(b) for a cost type sub-factors

$$r_{ij}=1-\frac{v_{ij}-v_{ij}^{\min}}{t_{ij}^{\max}}, \ j=1,..,J_i; i=1,..,I \quad (5)$$

Where

Max min, ij ij t t is the target and the lowest value of crisp sub-factor j under factors i.

Step 5: Calculate the normalized values by applying normalization procedure [8]:

$$\tilde{r}_{ij} = \left(\frac{L_{ij}}{U^*}, \frac{M_{ij}}{U^*}, \frac{U_{ij}}{U^*} \right), \quad j = 1,..,J_i; i = 1,..,I \quad (6)$$

(b) for a cost type sub-factors:

$$\tilde{r}_{ij} = \left(\frac{L^-}{U_{ij}}, \frac{L^-}{M_{ij}}, \frac{L^-}{L_{ij}} \right), \quad j = 1,...,J_i; i = 1,..,I \quad (7)$$

Where:

$U^* = U_{ij}^{max}, \quad j = 1,...,J_i; \; i = 1,..,I$

$L^- = L_{ij}^{min}, \quad j = 1,...,J_i; \; i = 1,..,I$

And L is the total number of linguistic expression which are defined for describing uncertain sub-factor Values.

Step 6: Calculate the weighted normalized values of identified factors, Ci

$$\tilde{C}_i = w_i \cdot \frac{1}{J_i} \cdot \sum_{j=1}^{J_i} \left(r_{ij} + \tilde{r}_{ij} \right) = (z; Li, M_i, U_i \quad (8)$$

Step 7: Marketing Strategy

Here the buyer's profile, market trends and design are required which can be showed in the first screen. The second screen contains information about macro trends, the third about industrial trends and the fourth screen contains information about potentials about product placement.

Step 8: Here the product development and its strategies are placed.

So by going through all the steps perfect recycled equipment can be modeled using fuzzy and uncertainty can be solved by proposed method.

CONCLUSIONS

In this paper, market evaluation of recycled equipment using fuzzy technique is discussed. The factors considered for the evaluation with the constraints are presented neatly. The assessment uncertainties in the relative importance factors and their values can be found using fuzzy technique. The fuzzy approach is simple way to find the solution with precise data. In this paper main contribution is the development of a mathematical model and software for evaluation recycling equipment with respect to market. Finally, marketing strategy lead to learn and improve of identified factors can be found. The proposed model clearly identifies the weakest parameters which should be the input for creating an enhanced business strategy in reverse logistic chain. The general limitations of the model are the need for well structured factors.

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