Fuzzy Set in Business Process Management as Reference Model

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***Abstract*-The Central theme of this article or paper is to uses the benefits or advantage of the Fuzzy set theory in Business to improve process, quality and extension of the business. In business the enterprise-specific for process improvement is characterized by decision-making premises. The decision does not exist in the form of mathematic models or numeric values. Decisions are characterized as thoughts, consideration and creativity. These are usually derived from fuzzy conditions such as low processing time and high quality . Although these conditions are not precise or accurate, but these condition consist additional and important information for the understanding of concrete business situations that are related to the business or any process. Thus the verbal information as well as vaguely formulated statements, premises, objectives and restrictions are very important for reference model adaptation. The systematic consideration of fuzzy set or data in reference model adaptation can only succeed when the models to be allow the consideration of fuzzy data. The fuzzy set theory-based extension of information modeling therefore provides the foundation for the development of a methodology, as well as the realization of a tool for reference model adaptation with regard to fuzzy data in this article.**

I. Introduction

While companies try to improve key business processes to maximize their own values, business processes are mostly managed based on experts‘ or leaders‘ experiences in business practice. Non-value added processes are sometimes overcontrolled. In this environment, a structured framework for a systematic BPM is required. However, there is a surprising lack of an overall framework to support improvements based on the data about the performance of each business process. In service industries such as life insurance, BPM is more salient than in the manufacturing industry. The process of acquiring and receiving services is a product itself in the service industry.

There are some difficulties in applying BPM in a service industry

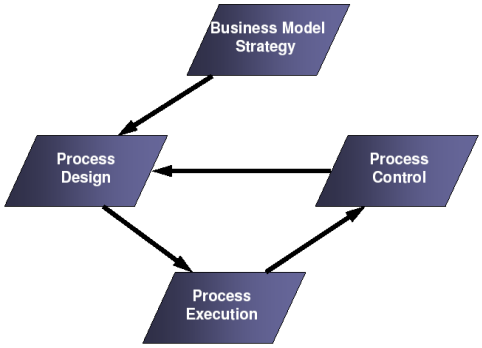
1) It is difficult to define processes and their flows. Flowcharts and process maps are hardly used in the service industry.

2) It is hard to measure process performance.

3) Some noisy or uncontrollable factors such as customer behavior influence service processes.

I. Fuzziness in Business Process Management

The goals in current business engineering projects lay in the design of business processes and the analysis of requirements for their IT-support with regard to corporate strategies. Process design must follow a comprehensive approach, comprising planning and control, i. e. the management of operational processes. Modeling has proved to be helpful for the support of systematic procedures in process design. Modeling languages like the event-driven process chain (EPC) serve as an operationalized approach to model construction. Software tools for business process modeling support the business engineer with system components for the analysis, design and simulation of business process models. Many concepts that consider situation-specific problems have been developed for the collection and improvement of business processes, their generalization in reference models and their enterprise-specific adaptation in customizing. Many of these approaches focus on the user-friendly and intuitive usability of methods by modeling them on human ways of thinking. More important for making the required decisions are however, the exact quantification and formalization of decision rules. However, in many cases, only uncertain, imprecise and vague information about the often not technically determined procedures is available for business processes. This circumstance will be met here by extending process modeling through the consideration and processing of fuzziness using the fuzzy-set-theory. This fuzzy extension will be reproduced with the EPC. The EPC was chosen as a process modeling language due significantly to its popularity in modeling practice. We will specify the term ―fuzziness" and motivate the consideration of fuzzy data using the fuzzy set theory. The life cycle of Business Process is mentioned in diagram.



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Life Cycle of Business Processes

II. CRISP TO FUZZY SETS

There is no standard definition for the term ―fuzziness". It almost seems as if the understanding of the term itself must remain fuzzy. Fuzziness is usually defined by way of differentiation with deterministic, stochastic and uncertain states of information. In this article, fuzziness is seen as uncertainty with regard to data and its interdependencies. Different reasons for fuzziness can be identified in the business context. First, fuzziness occurs due to the complexity of the environment and the limits in human perception when comprehending reality. The resulting informational fuzziness, determined by human language and thought, can be ascribed to a surplus of information. This happens when terms with a high level of abstraction are used. Thus for example, knowledge intensive processes contain short-lived information from a number of sources, which results in the fact that only one part of the total process can be covered at one point in time. This part however already becomes dated during the coverage of other sub-aspects. Many different attributes must be considered for the description of such complex terms. Fuzziness occurs because often, man is not capable of processing all of the relevant information and because, perhaps even the individual pieces of information are themselves already fuzzy. The descriptive attributes of the term are aggregated according to human information processing using linguistic terms. Fuzziness also exists in human preference and goal conceptions. In many situations, preferences human preference orders cannot be determined exactly.

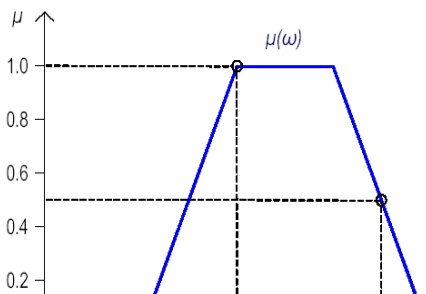
III. FUZZY SET THEORY

Fuzzy set theory is the sub domain of Soft Computing i.e. Fuzzy Logic + Neural Networks + Evolutionary Computing + Probabilistic reasoning . The crucial point in the fuzzy theory is that it is not only to evaluate conditions of objects with ―true" or ―false", but also rather to allow ―intermediate stages". So, the subsequent to Zadeh's original idea, the classic set theory, i. e. the theory of crisp sets, is extended by the description and combination of fuzzy sets. The grade of membership for each element ω of a predetermined (crisp) basic set w to a subset A that's belong to w, is expressed by a value μA(ω) of a mapping

1) μA : w ® [0;1].

2) μA is called the membership function of the fuzzy set {(ω; μA(ω)) | ω Î w}.

The value of membership function is lies between 0 and 1. Which is defined with the help of graph as below:-

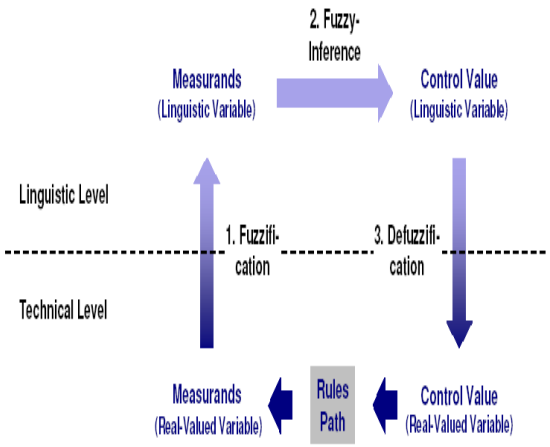


Membership Function for fuzzy set

IV. FUZZY SYSTEMS

A fuzzy system has a fixed set of input and output variables, whose respective terms are connected with fuzzy rules consisting of a condition and a conclusion part. For example ―WHEN customer assessment = middle AND order value = very high THEN order assessment = high". The value domains of the (linguistic) variables are partitioned by fuzzy sets, which serve the representation of the linguistic terms.

We can describe the fuzzy system as given below:-



Level or Working in Fuzzy System

Fuzzification:- Representation of crisp values on fuzzy sets.

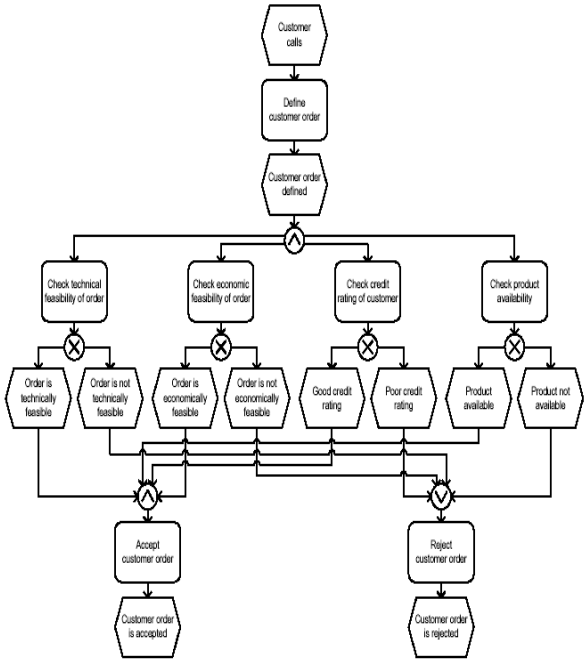
Fuzzy-Inference: -A fuzzy system consists of input and output variables, whose respective attributes are connected by rules, consisting of a premises and a conclusion. The input and output variables are assigned to one another by way of an inference procedure.

Defuzzification:- For an executable action, for example: ―set priority", a crisp value from the output variable is required. A defuzzification step provides this crisp value.

V. REFERENCE MODEL ADAPTATION WITH REGARD TO FUZZINESS

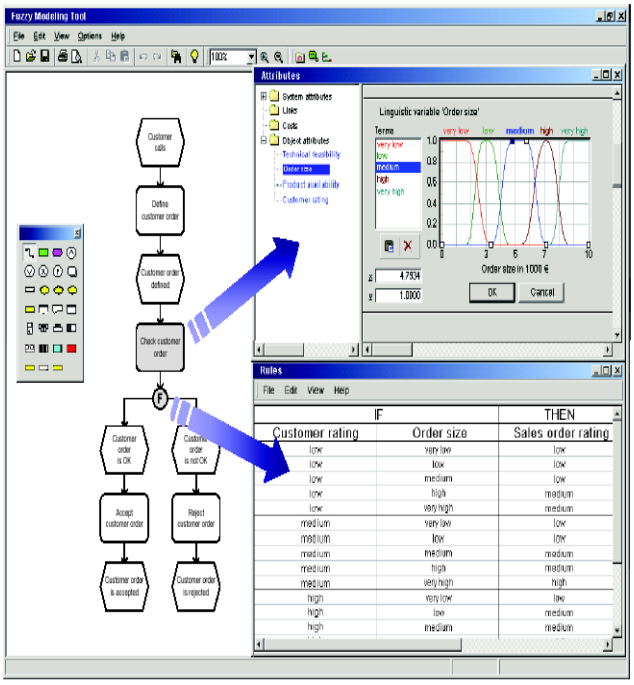
The fundamental idea followed here states that the systematic consideration of fuzzy data in the adaptation of reference models can only be successful when the models to be adapted themselves allow the consideration of fuzzy data. The fuzzy theory-based extension of information modeling is therefore the foundation for the development of a methodology, as well as for the prototypical realization of a tool for reference model adaptation under consideration of fuzzy data. The fuzzy theory makes the representation of the decision-logic based on the experience of those responsible for the business processes possible. By taking fuzzy conditions and vaguely formulated objectives into consideration, the user with technical process knowledge should himself be able to carry out the enterprise-specific adaptation of reference models using intuitive and simple linguistic evaluations. The adaptation-tool should like us

humans and make decisions on the basis of fuzzy terms. The following section justifies the consideration of fuzzy data in reference modeling and points
out its application potential using a simple example process for customer order processing. The following figure represents a part of a reference process for customer order processing in the form of an Event-driven Process Chain (EPC). The model describes the course of events for the definition and execution of the checking functions for a customer order. The decision regarding the acceptance or the refusal of the customer order is made by the parallel execution of various sub-functions. The customer order is checked for technical feasibility and in addition, the customer creditworthiness and the availability of the product are determined. Negative results, such as for example, –Order is not technically feasible" or –Poor credit rating", lead to the rejection of the customer order by way of the function –Reject customer order". The Reference Model for Customer Order processing is given below.



Reference Process Model for Customer Order Processing

A weak point in the modeled process immediately becomes obvious: each of the negative results leads to the immediate rejection of the customer order independent of the inspection results of the other functions. This is contradictory to business practice where such absolute elimination criteria are only rarely complied. In fact, through man as the decision-maker implicit compensation mechanisms are used, which counter-balance an exceedance of limiting values in one area with better values in another area. The rules for the interdependent impact are not documented here, but rather based upon the decision-makers know-how. Furthermore, it is usually a case of simple rules, which establish only scale-related combinations and which orient themselves on target systems with vague interdependences. In the present case, the decision as to whether a product is available could be answered not only with a crisp –Yes" or –No", but rather also be characterized by the additional effort resulting from weighing things up, so that the product for example, could be requested from another warehouse, if all other inspections turned out to be positive. A corresponding decision orients itself on the trade-off between the goal to avoid additional costs and the focus on customer needs. This results in the challenge to represent fuzziness in reference and procedure models for their adaptation, in addition to the problem of the development of implicit knowledge



Reference Process Model for Customer Order Processing with Fuzzy System

VI. Advantage of Fuzzy System

1) Only minor differences between output of simple fuzzy systems and complex crisp model.
2) Flexibility of Fuzzy-Systems by robustness and adaptability.
3) Similar to human way of thinking
4) If-Then-Rules easy to understand
5) Rule base can be maintained by user

A Fuzzy System can support a business process at least as good as a crisp system with less efforts and in a user centered way

VII. Future Challenges.

1) Extension of process and organisational aspects through fuzzy technology.
2) Formalisation of the fuzzy extension.
3) Establishing standards to include fuzzy-values in process description.
4) Implementation of a tool for fuzzy enterprise modeling.

VIII. Conclusion

The manageability of the adaptation of reference models finds itself in the tug-of-war between theoretical foundation and pragmatic simplicity and displays a high degree of complexity in practice. To reduce this complexity a modeling approach, allowing the consideration of fuzzy data and its possible usage has been outlined in this article. Business process models are limited to the content required by the end-user for the comprehension of the logic of business processes, while the technical knowledge necessary for the decision support of individual model-elements is deposited elsewhere. The fundamental idea followed states that the systematic consideration of fuzzy data in the adaptation of reference models can only be successful when the models to be adapted themselves allow the consideration of fuzzy data.

IX. References

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