Towards a Method for Aligning Organization Business Values with their BPMN Process Models

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Abstract

The strategic alignment of an organization's business values is crucial for success, necessitating seamless integration within process models to advance strategic objectives effectively. This study addresses the challenge of process models deviating from fundamental business values, leading to a disconnect with the organization's mission. By validating graphical representations of exchanged business values, this study proposes an approach to scrutinize value specifications in BPMN process models. Obstacles in measuring business value perception, due to its subjective and intangible nature influenced by factors such as quality, price, and emotional elements, are addressed using fuzzy logic. Through this, the study aims to mitigate subjectivity and ambiguity, providing a more precise understanding of stakeholders' value perceptions. The analysis seeks to determine alignment between perceived values and those specified in BPMN models, aiming for a robust alignment with organizational objectives.

Keywords

Process Modeling, BPMN, Business Values, Fuzzy Logic

1. Introduction

Business models are crucial for any organization, as they provide competitive advantages to differentiate entities within the same sector. In this context, business models serve as conceptual tools to articulate the primary business logic of an organization, describing the set of values that the organization offers to its clients and the networks of partners with whom it exchanges values in a sustainable and cost-effective manner [1].

The central idea in a business model is the concept of value, which explains the creation, addition, and exchange of value among stakeholders [2]. Value drive negotiations between companies and individuals, involving the exchange of goods. Therefore, when values are detailed in a process model from an economic perspective, this model can also be seen as a business model, determining the economic value exchanged and those involved in this exchange [3]. Thus, values, when specified, serve as a dependency variable between the needs of customers and the benefits of an organization's products or services [4]. Consequently, a process model,

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with specified values, can be used as an effective way to understand, evaluate, manage, and convey the fundamental concepts of a business [5, 3]. However, process models are not always aligned with the organization's objectives and strategies are needed to facilitate this alignment.

In this paper, we explore the feasibility of a method that allows examining the alignment between organizational business values and the values perceived by stakeholders during the execution of process models specified with BPMN. The selection of the BPMN language [6] is justified by its completeness [7] and widespread adoption [8]. This contributes to ensuring that the creation, delivery, and capture of values in process models are effectively achieved.

However, it is important to highlight that the concept of value used here is not limited solely to the monetary aspect; it also encompasses the notion of "relative value, usefulness, or importance" [4]. Furthermore, it is considered a multi-attribute variable, which implies that its evaluation requires consideration of various factors, including those intangible and subjective ones such as quality, price, emotional, and social elements. Therefore, measuring the adequacy of value in BPMN models represents a significant challenge. In order to address this challenge, this study adopts fuzzy logic [9] as a tool to reduce the subjectivity, imprecision, and vagueness in the responses of interviewed stakeholders. In addition, fuzzy logic can quantify linguistic nuances in data, both for individual assessment and group decision-making [10].

The use of fuzzy logic also facilitates the aggregation of individuals' subjective knowledge, which is crucial in data collection procedures applied to larger samples, as proposed in this study. However, it is important to highlight a restriction: it is not feasible to use the entire set of input data to create scenarios and thus exhaustively verify the specification of value with BPMN models. To address this issue, we opted for an quantitative validation approach. This approach aims to strike a balance between the completeness of exhaustive techniques and speed and ease of use. Thus, in this paper, we propose a method to align organization's business values with its BPMN process models.

The paper is organized as follows: after this introduction, Section 2 discusses related work. Section 3 introduces the proposed method, while Section 4 provides an example to show how the method can be used. Finally, Section 5 presents our conclusions and further work.

2. Related Work

Several studies have explored the alignment of business values with organizational processes, proposing approaches to facilitate this integration [11, 12, 13, 5, 14, 15, 3, 16, 17, 18, 19]. However, despite these efforts, there are still gaps in understanding the comprehensive representation of business values in process models.

One of these gaps is that all mentioned articles focus solely on tangible values in process models, ignoring the importance of values of other natures, such as social and emotional values. However, these values are also created, captured, and exchanged, and therefore should be represented and validated in process models. Papers like [15] even highlight the exclusion of intangible values as a limitation of their work. Thus, there is a clear research opportunity in this study, which aims to address the specification of values of all types in process models.

Furthermore, the methods proposed in the papers [14, 3, 18, 16] are merely illustrated in simplified examples simulating real cases. However, it is noteworthy that the method proposed

in [15] is demonstrated through case studies. On the hand, papers [11, 13, 5] perform a model-to-model consistency check. However, none of them provide validation of value representation in BPMN models considering stakeholders' value perception, as proposed in this study. Thus, this current work aims to address these limitations by proposing an instance-based approach, focusing on validating value specifications in BPMN process models. The proposed approach facilitates a comparative evaluation of specified and perceived values by stakeholders, offering prescriptive insights to guide business managers in identifying and addressing potential gaps. This, in turn, contributes to better alignment with organizational values and overall success.

3. Proposed Method

The method proposed in this study for aligning an organization's business values with its process models is applicable to the analysis of any BPMN process model. The method is divided into three stages, as presented below.

3.1. Stage 1: Identification of Modeled Values

In this stage, we aim to identify the values that the organization has modeled in its BPMN processes. This involves carefully analyzing the types of values involved and how stakeholders exchange value among themselves to understand which specific tasks, when carried out, generate these values. Clearly identifying the actors responsible for receiving and providing value, along with their specific contributions, is essential to quantifying the value exchange. In this work, the BPMN model value exchanges are represented through a message flow, as done in [19, 13]. Message flows are displayed as dashed lines with a circle at the start of the line and an arrowhead where the line ends, as illustrated in Figure 1.

3.2. Stage 2: Quantification of Perceived Value

This stage is subdivided into five steps: (*i*) execute of the process model; (*ii*) estimation of perceived value; (*ii*) quantification of perceived value per individual; (*iv*) quantification of perceived value per attribute; and (*v*) quantification of perceived value per dimension and per process. Below, these steps are detailed.

1. *Execute the process model*: this step involves stakeholders experiencing the process model under analysis to develop a perception of its value.

2. *Estimation of perceived value*: this step employs a modified version of the PERVAL (Perceived Value) scale [20] to capture the stakeholder's perceived value in questionnaire format. This scale measures four dimensions: (*i*) *quality*, which is the value of perceived quality and expected performance; (*ii*) *price*, which is the value of short- and long-term cost reduction; (*iii*) *emotional*, which is the value of feelings or effective states generated; and (*iv*) *social*, which is the value of enhancing individual social self-concept. Each dimension includes three analysis attributes, and for each of them, the respondent must select one of the following options:"*Totally Disagree (TD)*", "*Disagree (DG)*", "*Indifferent*

Table 1
Quality Dimension Analysis Attributes.

Attributes	TD	DG	IND	AG	TA
PV1.1)The overall quality is perceived as consistent					
PV1.2)The steps are perceived as well designed					
PV1.3)The level of quality is perceived as satisfactory					

(IND)", "*Agree (AG)* and "*Totally Agree (TA)*". Table 1 represents a fragment of the questionnaire, showcasing the organization of analysis attributes within the *quality* dimension. The other three dimensions are arranged similarly.

3. *Quantification of perceived value per individual*: this step is conducted through the use of fuzzy logic. At this step, each response obtained through the questionnaire will be associated with a corresponding Triangular Fuzzy Number (TFN) representing the linguistic terms used in the scale. In this case, a 50% association function will be used, as recommended for applications with satisfactory control [21]. This means that each fuzzy triangular region shares 50% overlapping with its neighboring region, a deliberate choice in this study. Using a TFN is useful in this context since the questionnaire responses are discrete values. However, in practice, the human perception tends to be a continue concept, without a clear transition from, for example, "*Agree*" to "*Totally Agree*". So, for "*Totally Disagree*", the TFN is (0, 0.2, 0.4); for "*Disagree*", the TFN is (0.2, 0.4, 0.6); for "*Indifferent*", the TFN is (0.4, 0.6, 0.8); for "*Agree*", the TFN is (0.6, 0.8, 1); and for "*Totally Agree*", the TFN is (0.8, 1, 1). After converting linguistic terms into TFNs, we have quantified the individual perceived value. Then, we conduct data evaluation. Analyzing individual responses provides a unique insight into the perception of value. Alternatively, evaluating the data by attribute, dimension and process provides a comprehensive assessment, aligning with the study's objective and thus chosen as the approach. To achieve this, in the next steps, we will conduct a knowledge aggregation process.

4. *Quantification of perceived value per attribute*: this step performs a knowledge aggregation process using the properties outlined in Equations 1, 2, and 3. The TFN is represented by (a, b, c), where these values correspond to linguistic terms, and X is the variable associated with the number of respondents for each attribute category. Thus, based on the collected data, calculations are performed to determine the fuzzy number for each attribute.

$$X.(a, b, c) = X.a; X.b; X.c \tag{1}$$

$$(a, b, c) + (a1, b1, c1) = (a + a1, b + b1, c + c1) \tag{2}$$

$$(a, b, c)/X = (a/X, b/X, c/X) \tag{3}$$

5. *Quantification of perceived value per dimension and per process*: this step is performed to quantify the perceived value by dimension and process, by replicating the procedure shown in previous steps. For the value by *Quality* dimension, for example, we aggregate

the fuzzy numbers of its analysis attributes (PV1.1, PV1.2, and PV1.3 - see Table 3). The same procedure applies to the other dimensions. Once the values by dimension are obtained, they are used to calculate the value by process.

3.3. Stage 3: Alignment of Modeled Value and Perceived Value

To assess the alignment, a comparative analysis is planned between the values modeled by the organization (identified in Stage 1) and the values perceived by stakeholders (identified in Stage 2). Alignment verification is conducted in two ways: initially, concerning the dimension (a more general approach), and subsequently, focusing on specific statements of perceived value (a more specific approach).

1. Alignment Analysis by Dimension - entails evaluating whether each dimension targeted during process modeling is perceived positively by stakeholders, in this case, the customers. This perception indicates the effectiveness of executing the value proposition across all attributes, dimensions, or processes. To conduct this assessment, we are using the b parameter of the TFN as a reference. The evaluation scale ranges from 0 to 1: b from 0 to 0.2 performance is considered "*very poor*", 0.2 to 0.4 as "*poor*", 0.4 to 0.6 as "*regular*", 0.6 to 0.8 as "*good*" and 0.8 to 1 as "*excellent*"[21].

2. Alignment Analysis by Value Statements - is conducted by comparing the responses obtained in the *additional questions* of the questionnaire (described below) and the modeled values.

   Additional Questions:
   1.) *Which company tasks influenced your perception regarding the attributes analyzed in the evaluated dimension?*
   2.) *How would you describe the value perceived in the execution of these tasks?*

4. Illustrative Example

We examined a BPMN model "*Vehicles Rental*" process (Fig. 1), which outlines the interconnected tasks and the values exchanged between the customers and the rental company to rent a vehicle. In this case, the stakeholder whose perceived value will be quantified is the customer, and for this purpose, we will utilize data collected from 10 customers.

4.1. Stage 1: Identification of Modeled Values

As highlighted in Section 3.1, at this stage, we identified the modeled values in the *Vehicles Rental* process in BPMN, represented as message flows. Table 2 presents the identified values along with their respective tasks and dimensions.

4.2. Stage 2: Quantification of Perceived Value

The steps to quantify the perceived value of "Vehicles Rental" customers are:

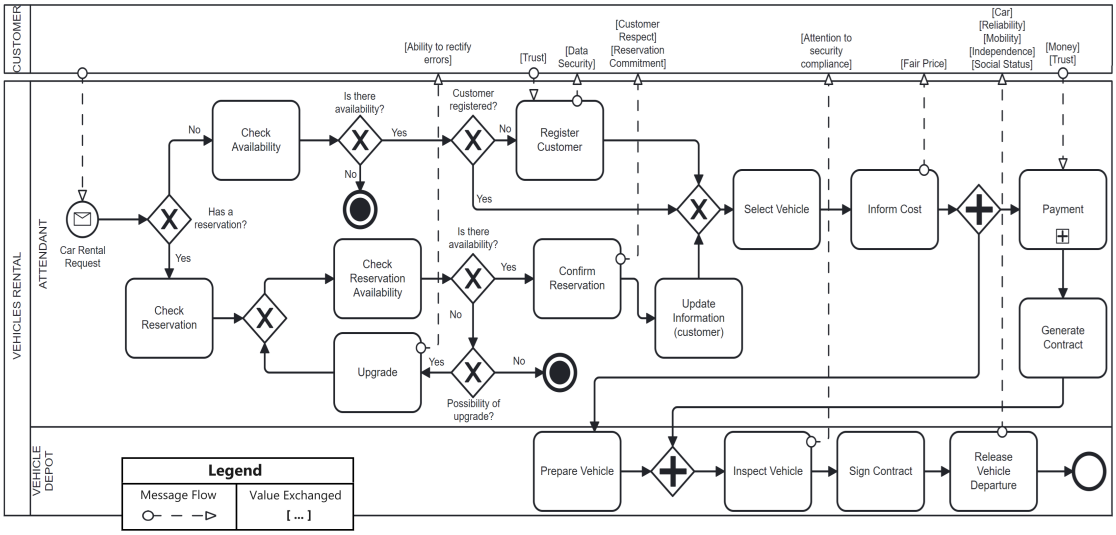

Figure 1: Vehicles Rental.

Table 2
Modeled Values.

Dimension	Value	Task
Quality	Ability to Rectify Errors	Upgrade
	Data Security	Register Customer
	Reservation Commitment	Confirm Reservation
	Attention to Security Compliance	Inspect Vehicle
Price	Fair Price	Inform Cost
Emotional	Customer Respect	Confirm Reservation
	Mobility	Release Vehicle Departure
	Independence	Release Vehicle Departure
Social	Social Status	Release Vehicle Departure

1. *Execute the process model*: in the execution of the process model "*Vehicles Rental*", the customer's "*Car Rental Request*" initiates a sequence of tasks for this purpose. Thus, if the customer has made a reservation, the company will "*Check Reservation*" and then "*Check Reservation Availability*". If the reserved car is not available, the company will always try offer an "*Upgrade*". The unavailability of the reserved car may generate a negative perception of value, but the offer of an "*Upgrade*" can mitigate this perception or even turn it positive by demonstrating the value of "*Ability to rectify errors*". Similar scenarios occur in other interactions that customers should experience.

2. *Estimate of perceived value*: after experiencing the BPMN model of *Vehicles Rental*, the customers will respond to the questionnaire (see Table 1), which includes attribute

Table 3
Quantified Value Perceived.

Code		Value by Attribute	Value by Dimension	Value by Process
Quality	PV1.1	(0.46, 0.66, 0.84)	(0.43, 0.63, 0.81)	(0.35, 0.55, 0.74)
	PV1.2	(0.44, 0.64, 0.82)		
	PV1.3	(0.4, 0.6, 0.78)		
Price	PV2.1	(0.34, 0.54, 0.74)	(0.36, 0.56, 0.76)	
	PV2.2	(0.38, 0.58, 0.78)		
	PV2.3	(0.36, 0.56, 0.76)		
Emotional	PV3.1	(0.34, 0.54, 0.74)	(0.32, 0.52, 0.72)	
	PV3.2	(0.32, 0.52, 0.72)		
	PV3.3	(0.3, 0.5, 0.7)		
Social	PV4.1	(0.28, 0.48, 0.68)	(0.28, 0.48, 0.68)	
	PV4.2	(0.3, 0.5, 0.7)		
	PV4.3	(0.26, 0.46, 0.66)		

analysis for quality, price, emotional, and social dimensions. The collected data will be quantified in the subsequent step.

3. *Quantify perceived value per individual*: the process will be conducted using the parameters of the fuzzification procedure described in Section 3.2.3. Thus, each response of "Totally Disagree" will be converted to (0, 0.2, 0.4); each "Disagree" response will be converted to (0.2, 0.4, 0.6); each "Indifferent" response will be converted to (0.4, 0.6, 0.8); each "Agree" response will be converted to (0.6, 0.8, 1); and each "Totally Agree" response will be converted to (0.8, 1, 1).

4. *Quantify Perceived Value per Attribute*: for attribute PV1.1 (Perceived Value 1.1), the following evaluations were recorded: 1 customer judged this attribute as *Totally Agree* (0.8, 1, 1), 3 customers rated it as *Agree* (0.6, 0.8, 1), 4 customers as *Indifferent* (0.4, 0.6, 0.8), and 2 customers as *Disagree* (0.2, 0.4, 0.6), totaling ten customers. Based on these data, in Equation 4 calculations will be performed to find the corresponding fuzzy number for the attribute. The same procedure applies to the remaining attributes, and the results can be seen in the *Value by Attribute* column of Table 3.

$$\frac{1.(0.8, 1, 1) + 3.(0.6, 0.8, 1) + 4.(0.4, 0.6, 0.8) + 2.(0.2, 0.4, 0.6)}{10} = (0.46, 0.66, 0.84) \quad (4)$$

5. *Quantify perceived value per dimension and process*: after replicating the process carried out in the previous step, we have the results that appear in the "*Value by Dimension*" and "*Value by Process*" columns in Table 3.

The aggregated interpretation of the perceived value of the participating customers in this study is conducted through the b parameter of the TFN. Table 3 shows that only the perceived value in the *Quality* dimension ($b = 0.63$) is considered good, while others are rated as regular, indicating that there is space for improvement in these dimensions.

4.3. Stage 3: Alignment between Modeled Value and Perceived Value

As explained in Section 3.3, in this stage, we examine the alignment of value for the Vehicle rental model by dimension and by value statement.

1. *Alignment Analysis by Dimension*: when comparing these results with the values modeled by the organization, as shown in Table 2, it is evident that all dimensions of consumer value perception were considered in the modeling. However, an individual analysis highlights the necessity for a prescriptive approach to enhance the less satisfactory results.

2. *Alignment Analysis by Value Statements*: in response to the first additional question, related to Quality dimension, the obtained responses included the following activities:

   a) *Task 1*: Upgrade.
   b) *Task 2*: Inspect Vehicle.

   Similarly, the responses obtained for the second additional question included:

   a) *Value related to task 1*: Customer attention.
   b) *Value related to task 2*: Compliance with contracted attributes.

When analyzing these responses and comparing them with Fig. 1, it is possible to verify the alignment between the modeled values and the perceived values. For example, upon observing Fig. 1, it becomes evident that, according to the modeling, the "*Upgrade*" task should demonstrate the "*Ability to Rectify Errors*", while in the consumer's perception, "*customer attention*" stands out. This analysis aims to examine the compatibility between the perceived value statement and the modeled value across all tasks. Furthermore, it's essential to evaluate whether any of the envisioned values are not being perceived by users. Take, for instance, a vehicle rental company that offers online reservation options through its website to enhance customer convenience and efficiency. Developing and upkeeping such a website requires investments in terms of costs and resources. Consequently, if customers fail to recognize the intended benefits through this platform, it signifies a misalignment between the envisioned values and the actual perception. This not only highlights an inefficiency in the process modeling but also suggests that the company's efforts to enhance customer service may have been fruitless, consuming both time and resources without yielding the desired results. This information is extremely relevant for guiding the organization regarding the efforts made and the returns obtained.

5. Conclusions and Future Work

Verifying the consistency between the specified values in a business model and those perceived by stakeholders is a crucial necessity faced by organizations on a daily basis. This comparative analysis enables organizations to identify potential gaps, taking measures to enhance alignment between their strategic objectives and the outcomes resulting from the execution of business processes modeled in BPMN, as detailed in this article.

An important aspect of the proposed method is its use of fuzzy logic for a more in-depth evaluation and understanding of value perceptions in BPMN models. By treating values as multifaceted variables, fuzzy logic seeks to mitigate the subjectivity, imprecision, and ambiguity

inherent in human reasoning, providing a more precise understanding of stakeholders' value perceptions. Through this analysis, the study aims to determine whether perceived values align with those specified in BPMN models, striving for a stronger alignment with organizational objectives. The presented method offers rapid feedback to those involved in specifying the business process through the definition of usage scenarios experienced by stakeholders themselves, distinguishing itself from exhaustive approaches.

While much research [12, 16, 3, 19, 13, 11] has been conducted in recent years to model values in a business model, this article highlights the importance of validating specified values with those perceived by stakeholders, an approach still under-explored. The relevance of this method is amplified by the fact that BPMN models are widely used by Information Systems designers and can be employed to validate the specification of use cases when implemented from processes. However, a critical analysis of the method revealed some limitations. Although it does not guarantee perfect consistency, as is common in exhaustive methods, it provides a certain level of confidence in consistency. Nonetheless, it is crucial to present scenarios to a variety of stakeholders to encompass a significant sample of real-world situations. Also, it is important to note that the challenge of gathering a variety of stakeholders to cover a set of scenarios to ensure a certain level of confidence in the consistency of specified and perceived values is still an open problem, to be addressed in future work.

In addition, other dimensions to quantify the perceived value such as *ethics* will be explored. To incorporate new dimensions into our method, we first need to identify the attributes that will be appropriate to respond these new dimensions and then expand our questionnaire accordingly. We can draw insights from prior work, like [22], which proposes attributes for analyzing consumer value perception from the perspective of eight constructs, including ethics. We also plan to develop a tool to automate the entire method and to include an AI-based recommendation system to be able to suggest possible process improvements aiming to enhance the stakeholders' perception of value.

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