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EFQM AND BUSINESS MODEL RELATION EFFECT ON PERFORMANCE OF MANUFACTURING ENTERPRISES

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ABSTRACT

In the changing business environment conditions, one of the primary management tasks is competitiveness enhancement. This goal can be achieved, among other things, by improving performance, which has the greatest impact on business success. This research paper aims to indicate that the alignment between the European Foundation for Quality Management (EFQM) model and the business model leads to an increase in enterprise performance. By applying the Fuzzy Simple Additive Weighting (FSAW) method and fuzzy algebra rules, the aggregated value of quality was calculated. Determining the value of the considered performance is set as a fuzzy decision-making problem. Aggregated performance value is given by fuzzy geometric mean with combined fuzzy algebra rules. By applying correlation analysis, the significance of the influence of business models and quality models on the value of performance was determined. The proposed model was tested on a sample of 20 SMEs that operate in the Republic of Serbia.

***Keywords**: EFQM, Business Model, Fuzzy Data, FSAW, Correlation Analysis*
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INTRODUCTION

Business excellence is usually defined as an outstanding practice in achieving results and in managing an organization based on a set of basic concepts or values [1][2]. These practices have evolved into business excellence models that seek to assist organizations in achieving world-class performances. The emphasis in this paper is on the European Foundation for Quality Management model (EFQM model) (previously known as EFQM excellence model). The EFQM model has undergone many changes over the years especially in its scoring system in order to follow the needs of the European market. Along with those changes practitioners and academics have made efforts to modify EFQM model scores and adapt it to various fields of study. The majority of authors believe that the weight of the criteria depends on the size of the company as well as the changes that occur in an uncertain environment [3][4][5][6]. It can be considered that the modification of the EFQM model is based on the change of weights of the criteria. Following the direction of quality development, business models have become a very important issue in the domain of business and management. Many practitioners and academics believe that a company's business can be presented through a business model. Regardless of the industry we are talking about, a properly established business model can provide a significant market advantage. Companies have always had business models, and it can be considered that there are as many business models as there are companies, because they differ at least in some characteristics. However, it is not always the case that a company recognizes its business model, and it can be said that a large number of companies, although operating according to a certain business model, are not actually aware of it [7]. Business models as a concept in recent years have reached a point that many authors consider stagnant due to the lack of qualitative studies [8][9][10] and additional explanations of the components of business frameworks [11][12] There is a significant number of papers in the literature that consider performance evaluation and selection [13][14][15][16]. The motive of this paper comes from the fact that the relation between these two concepts and their impact on organizational performance has not yet been confirmed in relevant literature. The premise is that organizations with adopted EFQM model are well aware of its business models and achieve better performances.

Uncertainties and inaccuracies that exist in the considered problem are modeled using the theory of fuzzy sets [17]. The aggregated value of quality is obtained by combining the EFQM method proposed by [6] and the FSAW method. Values of treated performance, in this research it is a number of customer complaints as suggested by [13] were evaluated during discretized time intervals. The total value of performance in a given time period was obtained by applying fuzzy geometric mean. In this research, representative scales of obtained fuzzy numbers are given by using simple gravity method. By using correlation analysis, the statistical significance of the influence of EFQM and business models on the value of performance can be determined. The aim of the paper is to show that there is a great statistical significance between the integrated model (which includes the business model and EFQM) and the value of the company's performance.

LITERATURE REVIEW

In this section, an overview of the relevant literature is given and divided in two parts: (i) EFQM model and (ii) business model components.

EFQM model

Over the years the EFQM model along with his criteria and criteria weights has evolved in order to keep pace with trends in business. The pioneer EFQM model was first launched in 1990 as a draft framework based on eight criteria [18]. After draft, the official model was released in 1992 [19] followed by its revisions from 1999 and 2003 [20]. Second model was distinguished by fundamental changes made on criteria scores in order to achieve a more balanced weighting scheme. This model was published in 2010 and revised in 2013 and contained nine criteria [21][22]. The latest model was released in 2019 and given a title EFQM 2020. The main focus of the new EFQM 2020 model according to [23] is shifted from excellence to outstanding results. This new version of model integrates the United Nations Sustainable

Development Goals (SDGs) and gains a wider scope of use (benchmarking performance, building a new business, understanding organizational maturity, etc.). EFQM 2020 model consists of seven criteria grouped in three dimensions in contrast to previous version which consisted of nine criteria grouped in two dimensions. The benefits of the application of this model are multiple and recorded in all areas of business [24][25][26][22]. The majority of authors believe that the model has to be adjusted to: (i) the size of the company, (ii) the business area and (iii) the uncertain business environment. It can be considered that the modification of the EFQM model is based on the change of weights of the criteria [3][4][5][6].

Business Model components

The number of definitions of the concept of business models that can be found in the literature is approximately the same as the number of business models. In the relevant literature, five different perspectives with the term Business model can be associated: (i) Business model activities, (ii) Business model logic, (iii) Business model archetypes, (iv) Business model alignment and (v) Business model components [27]. Authors adopting a perspective on business model components propose organizing business models around their essential elements to encompass crucial aspects of the business and establish operational frameworks. In the third development phase [28], they focused on aligning the concept of business model components (BMCs) and their interdependencies, resulting in a graphical representation of the business model framework. This visualization aimed to provide a clear depiction of the relationships between BMCs, aiding stakeholders in analyzing and evaluating the overall business model effectively. In the relevant literature, there is a large number of papers in which the problem of determining business model components [29][30][31][32][33], testing of frameworks [34] and systematization of identified components was discussed [35][36].

METHODOLOGY

Definition of a Finite Set of enterprises

For the purpose of this study, set of enterprises is selected under next criteria: (i) small and medium sized enterprises that operate on the territory of Republic of Serbia, (ii) belonging to the process manufacturing sector, and (iii) familiarity with EFQM model. These enterprises can be formally represented by the set $\{1, \dots, e, \dots, E\}$. The total number of enterprises is denoted as E, and $e, e = 1, .., E$ is the index of enterprises.

Construction of a modified EFQM model

The quality criteria may be presented by the set of indexes $\{1, .., k, .., K\}$ }, where K present the total number of quality criteria, and the index of each quality criterion is denoted as $k, k = 1, .., K$. These quality criteria are taken from EFQM 2020 model and are as follows: organizational culture and leadership $(k = 1)$, purpose, vision and strategy $(k = 2)$, stakeholder perceptions $(k = 3)$, strategic and operational performance $(k = 4)$, engaging stakeholders$(k = 5)$, creating sustainable value$(k = 6)$, and driving performance and transformation $(k = 7)$.

The assessment of the relative importance of defined criteria is stated as a fuzzy group decision making problem, as in [6]. The fuzzy weights vector at the level of each DM, $\widetilde{w}_{ke}$ is given by using fuzzy Best Worst Method [37]. The aggregation of DMs opinions into unique value is given by using fuzzy geometric mean, $\widetilde{\omega}_k$. The values of criteria are assessed by DMs by using pre-defined linguistic expressions which are modelled by TFNs, $\tilde{v}_{ek}$. The weighted fuzzy EFQM model for production SMEs [6] is constructed by using fuzzy algebra rules [17] and presented in Table 1.

Table 1. *The weighted fuzzy EFQM model for production SMEs*

	$k=1$	$k=2$	$k=3$	$k=4$	$k=5$	$k=6$	$k=7$
e=1	(0.22,0.28,0.51)	(0.27,0.42,0.76)	(0.46,0.88,1.72)	(0.90,1.57,2.97)	(0.28,0.49,0.93)	(0.33,0.63,1.19)	(0.53,1.16,2.48)
e=2	(0.22,0.28,0.51)	(0.27,0.42,0.76)	(0.71,1.12,1.96)	(0.82,1.47,2.81)	(0.28,0.49,0.93)	(0.33,0.63,1.19)	(0.90,1.58,2.97)
e=3	(0.24,0.30,0.54)	(0.30,0.45,0.81)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.17,0.38,0.82)	(0.36,0.68,1.26)	(0.82,1.47,2.81)
e=4	(0.30,0.36,0.54)	(0.30,0.45,0.81)	(0.78,1.20,2.07)	(1.12,1.89,2.97)	(0.37,0.63,0.99)	(0.33,0.63,1.19)	(1.13,1.89,2.97)
e=5	(0.22,0.28,0.51)	(0.30,0.45,0.81)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.17,0.38,0.82)	(0.21,0.49,1.05)	(0.82,1.47,2.81)
e=6	(0.24,0.30,0.54)	(0.30,0.45,0.81)	(0.78,1.20,2.07)	(0.52,1.16,2.48)	(0.30,0.53,0.99)	(0.21,0.49,1.05)	(0.90,1.58,2.97)
e=7	(0.14,0.22,0.45)	(0.17,0.33,0.67)	(0.46,0.88,1.72)	(0.52,1.16,2.48)	(0.12,0.28,0.61)	(0.33,0.63,1.19)	(0.82,1.47,2.81)
e=8	(0.22,0.28,0.51)	(0.17,0.33,0.67)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.12,0.28,0.61)	(0.21,0.49,1.05)	(1.13,1.89,2.97)
e=9	(0.24,0.30,0.54)	(0.17,0.33,0.67)	(0.46,0.88,1.72)	(0.37,0.84,1.82)	(0.12,0.28,0.61)	(0.33,0.63,1.19)	(0.82,1.47,2.81)
e=10	(0.24,0.30,0.54)	(0.37,0.54,0.81)	(0.78,1.20,2.07)	(0.90,1.57,2.97)	(0.37,0.63,0.99)	(0.36,0.68,1.26)	(1.13,1.89,2.97)
e=11	(0.30,0.36,0.54)	(0.30,0.45,0.81)	(0.71,1.12,1.96)	(0.82,1.47,2.81)	(0.12,0.28,0.61)	(0.36,0.68,1.26)	(1.13,1.89,2.97)
e=12	(0.22,0.28,0.51)	(0.27,0.42,0.76)	(0.71,1.12,1.96)	(0.90,1.57,2.97)	(0.30,0.53,0.99)	(0.21,0.49,1.05)	(0.82,1.47,2.81)
e=13	(0.24,0.30,0.54)	(0.27,0.42,0.76)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.12,0.28,0.61)	(0.33,0.63,1.19)	(0.53,1.16,2.48)
e=14	(0.24,0.30,0.54)	(0.27,0.42,0.76)	(0.78,1.20,2.07)	(0.90,1.57,2.97)	(0.37,0.63,0.99)	(0.36,0.68,1.26)	(1.13,1.89,2.97)
e=15	(0.14,0.22,0.45)	(0.27,0.42,0.76)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.30,0.53,0.99)	(0.36,0.68,1.26)	(1.13,1.89,2.97)
e=16	(0.24,0.30,0.54)	(0.17,0.33,0.67)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.28,0.49,0.93)	(0.33,0.63,1.19)	(0.53,1.16,2.48)
e=17	(0.24,0.30,0.54)	(0.30,0.45,0.81)	(0.71,1.12,1.96)	(0.82,1.47,2.81)	(0.37,0.63,0.99)	(0.36,0.68,1.26)	(1.13,1.89,2.97)
e=18	(0.24,0.30,0.54)	(0.27,0.42,0.76)	(0.46,0.88,1.72)	(0.82,1.47,2.81)	(0.30,0.53,0.99)	(0.36,0.68,1.26)	(0.90,1.58,2.97)
e=19	(0.24,0.30,0.54)	(0.30,0.45,0.81)	(0.71,1.12,1.96)	(0.90,1.57,2.97)	(0.28,0.49,0.93)	(0.21,0.49,1.05)	(1.13,1.89,2.97)
e=20	(0.24,0.30,0.54)	(0.27,0.42,0.76)	(0.71,1.12,1.96)	(0.90,1.57,2.97)	(0.28,0.49,0.93)	(0.33,0.63,1.19)	(0.90,1.58,2.97)

Source: [6]

Definition and classification of a Finite Set of Business Model Components

The BMC may be presented by the set of indexes $\{1,..,j,..,J\}$, where J presents the total number of BMCs, and the index of each BMC is denoted as $j, j = 1,..,J$. For the purpose of this case study set of BMCs systematized by [36] are used and presented in Table 2.

Table 2. *Definition and classification of a Finite Set of BMCs*

j=1	Business architecture	j=17	Finances	j=33	Relationship
j=2	Brand	j=18	Goods and services production and exchanges	j=34	Revenue (model, sources, stream)
j=3	Capabilities	j=19	Implementation	j=35	Rules and metrics
j=4	Capital (capital model)	j=20	Market segment	j=36	Scope
j=5	Commerce process model	j=21	Marketing strategy	j=37	Stakeholder (benefits and network)
j=6	Connected activities	j=22	Mission, mission structure	j=38	Supply chain
j=7	Core competences	j=23	Offering	j=39	Sustainability
j=8	Cost structure and Revenue stream, profit model	j=24	Organization (form and characteristics)	j=40	Sales (Target customer, target market)
j=9	Customer relations model	j=25	Partner network	j=41	Technology (core investments)
j=10	Customers (customer segments)	j=26	Price (scope, model, and strategies)	j=42	Trading mechanisms and protocols
j=11	Customized services	j=27	Process measure (nonfinancial)	j=43	Value capture
j=12	Governance	j=28	Processes	j=44	Value chain
j=13	Delivery channel	j=29	Procurement	j=45	Value configuration
j=14	Differentiation and strategic control	j=30	Profit	j=46	Value creation design
j=15	Distribution, distribution channel	j=31	Product/service	j=47	Value network with configuration
j=16	Equipment	j=32	Service provision	j=48	Value proposition

Source: [31]

Modeling of the Existing Uncertainties

In this paper, it is considered that the quality performance that has the most influence on the effectiveness of the business in production SMEs can be measured by performance indicator Customer complaints, such as suggested by [13]. If the company has implemented a quality system, it can be assumed that the value of this performance can be obtained from the records. However, best practice experience shows that quality managers are not obligated with presenting the exact data. On the other hand, determining this value can be posed as a problem for fuzzy group decision makers. Their values can be adequately described using seven pre-defined linguistic expressions:

very high value (V1): (1,1,2.5)

high value (V2): (1,2.5,4)

fairly high value (V3):(2.5,4,5.5)

medium value (V4):(3.5,5.5,7.5)

fairly low value (V5): (5.5,7,8.5)

low value (V6):(6,7.5,9)

very low value (V7):(7.5,9,9)

Quality managers as decision makers have been asked to evaluate total number of customer complaints for each year (2020,2021 and 2022).

The proposed method

The proposed algorithm is realized through the following steps.

Step 1. Fuzzy rating of customer complains is performed by quality managers on the level of each SME $e, e = 1,..,E$ for each observed time period $t, t = 1,..,T$

$$\tilde{v}_e^t = (l_e^t, m_e^t, u_e^t)$$

Step 2. The aggregated value of fuzzy rating of customer complains for observed time period is given by applying fuzzy geometric mean:

$$\tilde{v}_e = \left(\sqrt[T]{\prod_{t=1,..,T} l_e^t} , \sqrt[T]{\prod_{t=1,..,T} m_e^t} , \sqrt[T]{\prod_{t=1,..,T} u_e^t} \right) = (l_e, m_e, u_e)$$

Step 3. The representative scalar of TFN $\tilde{v}_e$, v_e is given by applying simple gravity method:

$$v_e = \frac{(u_e - l_e) + (m_e - l_e)}{3} + l_e$$

Step 4. The aggregated value of quality is obtained by applying Fuzzy SAW method according to constructed fuzzy EFQM model, $\tilde{q}_e$:

$$\tilde{q}_e = \sum_{k=1,...,K} \tilde{\omega}_k \cdot \tilde{v}_{ek}$$

Step 5. The representative scalar of TFNs $\tilde{q}_e$, q_e is given by using simple gravity method.

Step 6. Assessment of recognition of BCMs determined in [36] by strategic management of each considered SME $e, e = 1,.,E$ has been obtained through questionnaire designed as multiple choice. This value was calculated as the ratio of the number of identified BMCs to the total number of BMCs. This value has been denoted as $p_e, e = 1,..,E$.

Step 7. A multiple linear regression model that describes the dependence of customer complaints on two variables is set as follows:

$$\hat{v}_e = a + b_1 \cdot q_e + b_2 \cdot p_e$$

Step 8. Determining the partial correlation coefficients.

CASE STUDY

The proposed model has been tested on the real-life data obtained from 20 randomly selected SMEs from the Republic of Serbia. The common characteristic of the considered enterprises is that they are: i) familiar with EFQM as participated and evaluated in the EFQM award program (FQCE), ii) classified as SMEs, and iii) belong to the process manufacturing industry.

The identification of BMCs among considered enterprises was assessed by strategic management via online questionnaire. Multiple choice questions were given and obtained results were shown in percentage. Quality performance was assessed by quality managers at the level of each considered enterprise via email in which was explained that the estimations can be described using one of seven linguistic expressions for each year. Quality managers returned their evaluations by email to authors.

RESULTS

The values of the observed performance indicator customer complaints are assessed (Step 1 of the proposed Algorithm) and presented in table 3.

Table 3. *The assessed values of customer complaints*

SME	DM1	DM2	DM3	SME	DM1	DM2	DM3	SME	DM1	DM2	DM3
$e = 1$	V4	V6	V7	$e = 8$	V2	V5	V7	$e = 15$	V5	V5	V6
$e = 2$	V5	V5	V6	$e = 9$	V6	V6	V7	$e = 16$	V5	V7	V7
$e = 3$	V3	V5	V6	$e = 10$	V1	V2	V2	$e = 17$	V1	V3	V4
$e = 4$	V1	V1	V2	$e = 11$	V2	V2	V3	$e = 18$	V3	V6	V7
$e = 5$	V2	V4	V5	$e = 12$	V2	V3	V3	$e = 19$	V1	V3	V5
$e = 6$	V3	V4	V7	$e = 13$	V6	V7	V7	$e = 20$	V2	V2	V5
$e = 7$	V5	V7	V7	$e = 14$	V2	V3	V3				

The aggregated value of the observed performance for SME ($e = 1$) according to the proposed Algorithm (Step 2 to Step 3) is:

$$\tilde{v}_1 = \left(\sqrt[3]{3.5 \cdot 6 \cdot 7.5}, \sqrt[3]{5.5 \cdot 7.5 \cdot 9}, \sqrt[3]{7.5 \cdot 9 \cdot 9}\right) = (5.67, 7.33, 8.50)$$

By applying FSAW and simple gravity method (Step 4 to Step 5 of the proposed Algorithm) the value of quality model is calculated and illustrated for SME ($e = 1$):

$$v_1 = \frac{(8.50 - 5.67) + (7.33 - 5.67)}{3} + 5.67 = 6.430$$

In a similar way, the values of the quality model were obtained for other SMEs, as shown in Table 4.

Table 4. *Input data for regression analysis*

SME	$EFQM$	BMCs	Customer complains	SME	$EFQM$	BMCs	Customer complains
$e = 1$	6.430	0.560	7.167	$e = 11$	6.983	0.730	3
$e = 2$	6.883	0.710	7.170	$e = 12$	6.787	0.730	3.50
$e = 3$	6.523	0.600	6.170	$e = 13$	6.007	0.520	7.50
$e = 4$	7.640	0.770	1.833	$e = 14$	7.433	0.670	3.5
$e = 5$	6.317	0.650	5	$e = 15$	6.843	0.730	7.170
$e = 6$	6.623	0.690	6	$e = 16$	6.143	0.540	7.997
$e = 7$	5.640	0.480	7.997	$e = 17$	7.270	0.810	3.667
$e = 8$	6.363	0.600	6.003	$e = 18$	6.753	0.670	6.663
$e = 9$	5.527	0.420	7.833	$e = 19$	7.103	0.650	4.167
$e = 10$	7.523	0.750	2	$e = 20$	7.020	0.710	4

The number of BMCs identified by strategic management were collected (Step 6 of the proposed Algorithm) and presented in Table 4.

Multiple regression analysis was conducted using Ms Excel to derive rules that describe the relationship between the number of complaints and the quality model, as well as the number of recognized business model components (BMCs). Additionally, partial correlation coefficients were calculated as part of steps 7 to 8 of the proposed algorithm:

$$r = \frac{-0.83 - (-0{,}75) \cdot 0{,}89}{\sqrt{1 - 0{,}75^2} \cdot \sqrt{1 - 0{,}89^2}} = -0.54$$

Partial correlation coefficients are shown in Table 5.

Table 5. *Partial correlation coefficients*

	EFQM	BMCs	Quality performance
EFQM	1		
BMCs	0.89	1	
Quality performance	-0.83	-0.75	1

The research findings indicate a significant positive correlation (0.89) between the values of the criteria outlined in the EFQM model and the recognition percentage of business model components (BMCs). This implies that SMEs that are familiar with and adhere to the EFQM model in their operations tend to have a clear understanding and recognition of their business models. Consequently, it can be inferred that companies adopting EFQM model prioritize quality in their business models.

Furthermore, the partial correlation coefficient between the EFQM model and customer complaints is found to be highly negative (-0.89). This indicates that as the EFQM model criteria values increase, the number of customer complaints decreases, and vice versa. Similarly, there is a strong negative correlation between the business model and customer complaints. In essence, when a company aligns its quality model with its business model, it experiences a reduction in customer complaints, leading to improved performance and increased effectiveness in its operations.

In summary, the research suggests that a strong connection exists between the EFQM model, the recognition of BMCs, and quality performance indicator customer complaints. By integrating a quality model like EFQM into their business model, companies can decrease customer complaints, enhance quality performance, and elevate overall business effectiveness.

REFERENCES

[1] Marković, V., Stajić, L., Stević, Ž., Mitrović, G., Novarlić, B., & Radojičić, Z. (2020). A novel integrated subjective-objective mcdm model for alternative ranking in order to achieve business excellence and sustainability. Symmetry, 12(1), pp. 164.

[2] Sulistyo, B., Amani, H., Widaningrum, S., Mohammad, M., & Ibrahim, R. (2021). Comparative Study of Business Excellence Frameworks and Awards in Southeast Asian Countries. International Journal of Business and Society, 22(3), pp. 1123-1142.

[3] Jankalová, M., & Jankal, R. (2018). Sustainability assessment according to the selected business excellence models. Sustainability, 10(10), pp. 3784.

[4] Rahman, M., Islam, R., Wan Husain, W. R., & Ahmad, K. (2019). Developing a hierarchical model to enhance business excellence in hotel industry of Bangladesh. International Journal of Contemporary Hospitality Management, 31(4), pp. 1836-1856.

[5] Amponsah, C. T., & Ahmed, G. (2017). New global dimensions of business excellence. International Journal of Business Excellence, 13(1), pp. 60-78.

[6] Petrović, T., Vesić Vasović, J., Komatina, N., Tadić, D., Klipa, Đ., & Đurić, G. (2022). A Two-Stage Model Based on EFQM, FBWM, and FMOORA for Business Excellence Evaluation in the Process of Manufacturing. Axioms, 11(12), pp.704.

[7] Linder, J. C., & Cantrell, S. (2001). Five business-model myths that hold companies back. Strategy & Leadership, 29(6), pp. 13-18.

[8] Budler, M., Župič, I., & Trkman, P. (2021). The development of business model research: A bibliometric review. Journal of Business Research, 135, pp. 480-495.

[9] Bhatti, S. H., Santoro, G., Khan, J., & Rizzato, F. (2021). Antecedents and consequences of business model innovation in the IT industry. Journal of Business Research, 123, pp. 389-400.

[10] Lüdeke-Freund, F. (2020). Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research. Business Strategy and the Environment, 29(2), pp. 665-681.

[11] Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. Journal of cleaner production, 198, pp. 401-416.

[12] Parida, V., Sjödin, D., & Reim, W. (2019). Reviewing literature on digitalization, business model innovation, and sustainable industry: Past achievements and future promises. Sustainability, 11(2), pp. 391.

[13] Nestić, S., Gojković, R., Petrović, T., Tadić, D., & Mimović, P. (2022). Quality Performance Indicators Evaluation and Ranking by Using TOPSIS with the Interval-Intuitionistic Fuzzy Sets in Project-Oriented Manufacturing Companies. Mathematics, 10(22), pp. 4174.

[14] Kailash, Saha, R. K., & Goyal, S. (2019). Benchmarking model to analyse ISCM performance of selected Indian manufacturing industries using fuzzy AHP technique. International Journal of Industrial and Systems Engineering, 33(1), pp. 1-16.

[15] Cristea, C., & Cristea, M. (2021). KPIs for operational performance assessment in flexible packaging industry. Sustainability, 13(6), 3498.

[16] Kang, N., Zhao, C., Li, J., & Horst, J. A. (2016). A Hierarchical structure of key performance indicators for operation management and continuous improvement in production systems. International journal of production research, 54(21), 6333-6350.

[17] Zimmermann, H. J. (2010). Fuzzy set theory. Wiley interdisciplinary reviews: computational statistics, 2(3), pp. 317-332.

[18] Conti, T. A. (2007). A history and review of the European Quality Award Model. The TQM magazine, 19(2), pp. 112-128.

[19] Samuelsson, P., & Nilsson, L. E. (2002). Self-assessment practices in large organisations: Experiences from using the EFQM excellence model. International journal of quality & reliability management, 19(1), pp. 10-23.

[20] Ruiz-Carrillo, J. I. C., & Fernández-Ortiz, R. (2005). Theoretical foundation of the EFQM model: the resource-based view. Total Quality Management & Business Excellence, 16(1), pp. 31-55.

[21] Escrig, A. B., & de Menezes, L. M. (2015). What characterizes leading companies within business excellence models? An analysis of "EFQM Recognized for Excellence" recipients in Spain. International Journal of Production Economics, 169, pp. 362-375.

[22] Suárez, E., Calvo-Mora, A., Roldán, J. L., & Periáñez-Cristóbal, R. (2017). Quantitative research on the EFQM excellence model: A systematic literature review (1991–2015). European Research on Management and Business Economics, 23(3), pp. 147-156.

[23] Fonseca, L. (2022). The EFQM 2020 model. A theoretical and critical review. Total Quality Management & Business Excellence, 33(9-10), pp. 1011-1038.

[24] Calvo-Mora, A., Picón-Berjoyo, A., Ruiz-Moreno, C., & Cauzo-Bottala, L. (2015). Contextual and mediation analysis between TQM critical factors and organisational results in the EFQM Excellence Model framework. International Journal of Production Research, 53(7), pp. 2186-2201.

[25] Boulter, L., Bendell, T., & Dahlgaard, J. (2013). Total quality beyond North America: A comparative analysis of the performance of European Excellence Award winners. International Journal of Operations & Production Management, 33(2), pp. 197-215.

[26] Gutiérrez, L. G., Torres, J. T., & Morales, V. J. G. (2010). Un estudio empírico del impacto de las iniciativas actuales de gestión de la calidad sobre la innovación y flexibilidad organizativa. Spanish Journal of Finance and Accounting/Revista Española de Financiación y Contabilidad, 39(148), pp. 677-709.

[27] Ritter, T., & Lettl, C. (2018). The wider implications of business-model research. Long range planning, 51(1), pp. 1-8.

[28] Chroneer, D., Johansson, J., & Malmstrom, M. (2015). Business model management typologies-cognitive mapping of business model landscapes. International Journal of Business and Management, 10(3), pp. 67-80.

[29] Teece, D. J. (2018). Business models and dynamic capabilities. Long range planning, 51(1), pp. 40-49.

[30] Al-Debei, M. M., & Avison, D. (2010). Developing a unified framework of the business model concept. European journal of information systems, 19(3), pp. 359-376.

[31] Saebi, T., & Foss, N. J. (2015). Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions. European Management Journal, 33(3), pp. 201-213.

[32] Wirtz, B. W., Pistoia, A., Ullrich, S., & Göttel, V. (2016). Business models: Origin, development and future research perspectives. Long range planning, 49(1), pp. 36-54.
[33] Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. Journal of cleaner production, 198, pp. 401-416.
[34] Bradley, P., Parry, G., & O'Regan, N. (2020). A framework to explore the functioning and sustainability of business models. Sustainable Production and Consumption, 21, pp. 57-77.
[35] Shafer, S. M., Smith, H. J., & Linder, J. C. (2005). The power of business models. Business horizons, 48(3), pp. 199-207.
[36] Nestić, S., Aleksić, A., Lafuente, J. G., Cvetić, T., & Đurić, G. (2022). The Allocation of Business Model Components under Presence of Uncertainties by the Branch-and-Bound Method. Mathematical Problems in Engineering, 2022.
[37] Hafezalkotob, A., & Hafezalkotob, A. (2017). A novel approach for combination of individual and group decisions based on fuzzy best-worst method. Applied Soft Computing, 59, pp. 316-325.

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