

Универзитет Привредна академија у Новом Саду
University Business Academy in Novi Sad

Факултет за примењени менаџмент, економију и финансије Београд
Faculty of Applied Management, Economics and Finance Belgrade

ФАКУЛТЕТ ЗА
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MEFKON22

International Scientific & Professional Conference

МЕЂУНАРОДНА НАУЧНО-СТРУЧНА КОНФЕРЕНЦИЈА

INNOVATION AS AN INITIATOR OF THE DEVELOPMENT

ИНОВАЦИЈЕ КАО ПОКРЕТАЧ РАЗВОЈА

INTERNATIONAL CONFERENCE PROCEEDINGS

ЗБОРНИК РАДОВА СА МЕЂУНАРОДНОГ СКУПА

INNOVATIONS

December 1st
Belgrade, 2022

Универзитет Привредна академија у Новом Саду

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Факултет за примењени менаџмент, економију и финансије, Београд

Faculty of Applied Management, Economics and Finance, Belgrade

Међународна научно-стручна конференција

International Scientific & Professional Conference

МЕФкон 2022 / MEFkon 2022

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Београд, 1. децембар 2022. године
Међународна научно-стручна конференција

МЕФкон 2022:

„Иновације као покретач развоја“

Зборник радова са међународног скупа –
електронско издање

**радови су објављени у изворном облику*

Belgrade, December 1st 2022

International Scientific & Professional Conference

MEFkon 2022:

“Innovation as an Initiator of the Development”

International Conference Proceedings – *digital
edition*

**papers were published in the original form*

Издавач / Publisher

Факултет за примењени менаџмент, економију и финансије Београд
Faculty of Applied Management, Economics and Finance Belgrade

За издавача / For the Publisher

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Sanja Anastasija Marković, MSc
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Дизајн / Design

Strahinja Vidojević, Bsc

Штампа / Print

Факултет за примењени менаџмент, економију и финансије Београд
Faculty of Applied Management, Economics and Finance Belgrade

Тираж / Number of copies

100

ISBN 978-86-84531-59-1

Организатор / Organizer:

Факултет за примењени менаџмент, економију и финансије, Београд
Faculty of Applied Management, Economics and Finance, Belgrade

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ПРЕДГОВОР

Иновације су и даље свуда око нас, па и ове године, традиционално као и седам претходних, Факултет за примењени менаџмент, економију и финансије је на основу пристиглих чланака, свеобухватног тематског аспекта припремио зборник радова. Примерено наслову „Иновације као покретач развоја“ иновације означавају и генеришу будућност, али почињу у садашњости која мора бити осветљена, анализирана и разматрана. Управо су то учинили многи угледни универзитетски професори, истакнути истраживачи, експерти и научни радници, како из Србије, тако и из иностранства послатим радовима (преко 50), које смо уврстили у овај зборник.

Зборник радова међународног значаја, категорисан у домаћој науци као МЗЗ, је у форми дигиталне едиције и биће доступан широј научној и стручној јавности. Радови у овој публикацији значајно доприносе утврђивању нераскидиве везе између иновација и развоја. Истовремено смо тиме показали да подручје иновација дефинитивно више није везано само за техничко – технолошки прогрес. У складу са тим, радови могу бити корисни и широј научној и стручној јавности, као и свим заинтересованим за утицај иновација на развој.

Београд,

Децембар, 2022.

Уредници

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FOREWORD

Innovations are still all around us, so this year, traditionally as well as the previous seven, the Faculty of Applied Management, Economics and Finance have prepared a book of proceedings of comprehensive thematic aspect based on the received articles. Appropriate to the title " Innovation as the initiator of development", innovation means and generates the future, but it begins in the present that must be illuminated, analyzed, and considered. This is exactly what many eminent university professors, prominent researchers, experts, and scientists, both from Serbia and abroad, have done with the submitted papers (over 50), which we have included in this collection.

The book of proceedings of international importance, categorized in domestic science as M33, is in the form of a digital edition and will be available to the wider scientific and professional public. The papers in this publication significantly contribute to establishing the unbreakable link between innovation and development. At the same time, we have shown that the field of innovation is no longer related only to technical-technological progress. Accordingly, the works can be useful to the general scientific and professional public, as well as to all those interested in the impact of innovation on development..

Belgrade,

December, 2022

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САДРЖАЈ / CONTENT

РАДОВИ СА КОНФЕРЕНЦИЈЕ

CONFERENCE PAPERS

Ahmet Aytekin Selçuk Korucuk Çağlar Karamaşa	EVALUATION OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT BARRIERS IN TERMS OF BUSINESS FACTOR FOR TEXTILE FIRMS: CASE STUDY FOR ORDU	1
Alexander Dubovitski Elvira Klimentova Matvei Rogov	FORECASTING THE PARAMETERS OF THE DEVELOPMENT OF FOOD MARKETS BASED ON MACHINE LEARNING MODELS USING A NEURAL NETWORK	9
Matija Kovačić Marko Čičin-Šain Vedran Milojica	CYBER SECURITY AND TOURISM: BIBLIOMETRIC ANALYSIS	17
Gabrijela Popović Đorđe Pucar Florentin Smarandache	MEREC-COBRA APPROACH IN E-COMMERCE DEVELOPMENT STRATEGY SELECTION	28
Dusan Rajic	SOLVING THE SAME INVENTIVE PROBLEM USING TWO DIFFERENT CONTRADICTION MATRIXES	37
Selçuk Korucuk Ahmet Aytekin Çağlar Karamaşa	A QUANTITATIVE ANALYSIS TOWARD OUTSOURCING RELATED RISKS AND PROBLEMS IN LOGISTICS ENTERPRISES: CASE STUDY FOR GIRESUN	47
Dominik Patafta	THE ROLE OF COMMUNICATION AND SUSTAINABILITY IN THE HOTEL BUSINESS OPERATIONS – THEORETICAL FRAMEWORK	57

Ivona Brajević Miodrag Brzaković Dušan Rajčević	EXPLORING BOUND HANDLING METHODS FOR RAO ALGORITHM	64
Dušan Rajčević Miodrag Brzaković Ivona Brajević	IMAGE THRESHOLDING USING IMPROVED CHAOTIC FIREFLY ALGORITHM	71
Tamara Ranisavljević Darjan Karabašević Dragiša Stanujkić	OBSERVING THE CLOUD COMPUTING TECHNOLOGY FROM THE NIST DEFINITION POINT OF VIEW	78
Ivona Brajević Miodrag Brzaković Goran Jocić	HYBRID BEETLE ANTENNAE SEARCH ALGORITHM FOR SOLVING CONSTRAINED WEBER PROBLEM	89
Tamara Ranisavljević Aleksandar Šijan Luka Ilić	THE POWER OF THE DART PROGRAMMING LANGUAGE FOR MODERN, HIGH- PERFORMANCE WEB APPLICATION DEVELOPMENT	96
Dusan Rajic	GENERATION OF INNOVATIONS ACCORDING TO THE CRITERION OF SUSTAINABLE DEVELOPMENT	103
Vladislav Bessarabov	SCIENTIFIC AND METHODOLOGICAL APPROACH TO THE FORMATION OF KEY INDICATORS OF ECONOMIC SECURITY OF ENTREPRENEURIAL ACTIVITY	112
Vesna Martin	COVID-19 IN SERBIA: POLICY MEASURES TAKEN AND IMPLICATIONS FOR ECONOMIC AND FINANCIAL STABILITY	122
Romina Alkier Vedran Milošić Milena Podovac	TOURIST'S PERCEPTION OF SAFETY ON BEACHES OF OPATIJA RIVIERA	132

Nagy Cristina Mihaela Sava Cipriana Voin Alin	CASE STUDY REGARDING THE ANALYSIS OF SPECIFIC CAPITAL INDICATORS OF A COMPANY IN THE PHARMACEUTICAL INDUSTRY	142
Maja Mutavdžija Marko Čičin-Šain Slobodan Ivanović	ANALYSIS OF THE IMPACT OF DIGITAL SKILLS GAP INDEX (DSGI) SCORE ON GLOBAL TRAVEL AND TOURISM	149
Jelena Blečić Svetlana Vukotić Vuk Mirčetić	COMPARATIVE ANALYSIS OF WOMEN'S POSITION IN LEADERSHIP	159
Katarina Toković	CONSEQUENCES OF THE DISRUPTION OF DISINFECTANTS DISTRIBUTION IN CROATIA AND THE EUROPEAN UNION	166
Ivan Paunovic Tatjana Mamula	STRATEGIC FAMILY WINERY BRAND LAUNCH IN THE VUCA (VOLATILITY, UNCERTAINTY, COMPLEXITY, AMBIGUITY) MARKET: THREE CASE STUDIES FROM SERBIAN MARKET	175
Mahir Zajmović	SLOŽENI TIPOVI PODATAKA I NJIHOVA IMPLEMENTACIJA U PROGRAMSKOM JEZIKU C++	184
Ines Isaković	AGILNE METODOLOGIJE RAZVOJA SOFTVERA	195
Светлана Марковић Илья Шакалов Миодраг Брзаковић	ЗАШТИТА ИНТЕЛЕКТУАЛНЕ СВОЈИНЕ У УПРАВАМА У УСЛОВИМА ИТ РИЗИКА	203
Olgica Milošević	DOMAŠAJ NAČELA SLOBODE UGOVARANJA PRI ZAKLJUČENJU FORMULARNIH UGOVORA	211
Гордана Петровић Светлана Вукотић	МЕЂУНАРОДНА ТРГОВИНА КАО ИНДИКАТОР ЕКОНОМСКЕ	218

Cipriana Sava	ГЛОБАЛИЗАЦИЈЕ	
Дејан Обућински Сузана Дољаница Оливер Момчиловић	АНАЛИЗА МЕЂУСОБНОГ ОДНОСА ФАКТОРА ЕКОНОМИЈЕ ОБИМА И УПРАВЉАЊЕ У ТРЕНУТНИМ ТРЖИШНИМ УСЛОВИМА	225
Kosana Vićentijević	KONSEKVENCE CIRKULARNE ЕКОНОМИЈЕ НА РАЋУНОВОДСТВЕНУ REGULATIVU	234
Миља Орландић Јелена Петровић Адам Малешевић	ТЕОРИЈСКИ АСПЕКТИ СОЦИЈАЛНОГ КАПИТАЛА КАО СТАБИЛИЗАЦИОНИ МЕХАНИЗМИ У ЕФИКАСНОМ УПРАВЉАЊУ	243
Sejdefa Dzafče Belma Hadzikamber	GLOBALNI IZAZOVI ОПОРЕЗИВАЊА КОРПОРАТИВНЕ ДОБИТИ – КОМПАРАТИВНИ ПРЕГЛЕД	250
Југослав Аничич Гордана Петровић Душан Аничич	МОНЕТАРНА ПОЛИТИКА У ФУНКЦИЈИ РЕШАВАЊА ЕКОНОМСКЕ КРИЗЕ – МОГУЋНОСТИ И ОГРАНИЧЕЊА	260
Бранкица Тодоровић	ФИСКАЛНА И МОНЕТАРНА ПОЛИТИКА У УСЛОВИМА ПАНДЕМИЈЕ COVID-19	267
Adnan Salkić	INFLACIЈА CIЈENA U EU I EUROZONI-TROŠKOVI POTROŠAČKE KORPE U EUROPSKOЈ UNIЈI I ВИH	273
Павле Брзаковић Катарина Брзаковић Предраг Тодоров	ИЗБОР ПОКАЗАТЕЉА ПЕРФОМАНСИ И КЉУЧНИ ИНДИКАТОРИ УЧИНКА – КPI	281
Немања Будимир	ФИНАНСИЈСКИ РЕВИЗОРИ И ИТ КОМПЕТЕНЦИЈЕ	290
Nemanja Gogić	РАЋУНОВОДСТВЕНИ IZVEŠTAЈI I POSLOVNE KNJIGE	303
Бранкица Тодоровић	ОДРЖИВЕ ФИНАНСИЈЕ У САВРЕМЕНИМ ПРЕДУЗЕТНИЧКИМ	313

АКТИВНОСТИМА		
Миља Орландић Тијана Ђукић Габријела Поповић	ЕВАЛУАЦИЈА ПОДСТИЦАЈНИХ ФАКТОРА ЗНАЧАЈНИХ ЗА РАЗВОЈ ПРЕДУЗЕТНИШТВА	320
Jozo Piljić	VELIKE ZAMKE ZA START-UP RODUZETNIKE	328
Тијана Ђукић Марија Јаношиќ Кристина Јауковић Јоцић	УТИЦАЈ ВЕШТАЧКЕ ИНТЕЛИГЕНЦИЈЕ НА ЉУДСКЕ РЕСУРСЕ У ДИГИТАЛНОМ ДОБУ: СЕЛЕКЦИЈА КАНДИДАТА	337
Ružica Đervida Adriana Radosavac Milja Orlandić	ZNAČAJ KOMUNIKACIJE ZA RAZVOJ KORPORATIVNIH ODNOSA SA JAVNOŠĆU	345
Татјана Јановац	АНАЛИЗА ИНТЕРНИХ ФАКТОРА ЛИДЕРСТВА У ЦИЉУ СПРОВОЂЕЊА РЕФОРМИ ЈАВНОГ СЕКТОРА: СТУДИЈА СЛУЧАЈА СЕКТОР ЗА ЉУДСКЕ РЕСУРСЕ МУП-А РЕПУБЛИКЕ СРБИЈЕ	351
Слободан Васић Јасмина Секеруш	УТИЦАЈ ИНОВАЦИЈА НА РАЗВОЈ ВИНСКОГ ТУРИЗМА	360
Miloš Ivaniš Živan Bajić	MENADŽMENT INOVACIJA KAO PROCES	371
Марко Филијовић	ПРИМЕНА СВЕМИРСКИХ ТЕХНОЛОГИЈА НА ЗЕМЉИ: ТРАНСФЕР ЗНАЊА И ИНОВАТИВНА РЕШЕЊА	381
Владо Радић Никола Радић Ненад Равић	ТЕХНОЛОШКЕ И ЕКОНОМСКЕ ИМПЛИКАЦИЈЕ ПРИМЕНЕ НАПРЕДНИХ МАТЕРИЈАЛА У ЕЛЕКТРИЧНИМ ВОЗИЛИМА	393
Miloš Ivaniš Živan Bajić	MODELI UPRAVLJANJA INOVACIJAMA	403

Тихомир Радовановић		
Марко Филијовић	КРЕИРАЊЕ СИСТЕМА ОДРЖИВОГ РАЗВОЈА	412
Павле Раданов		
Никола Радић		
Владо Радић	ОДРЖИВИ РАЗВОЈ И ЕНЕРГЕТСКА ТРАНЗИЦИЈА	423
Марија Марковић- Благојевић		
Зоран Ристић	ИЗАЗОВИ ПОЛИТИКЕ ЗАПОШЉАВАЊА У ПРОЦЕСУ ЕВРОИНТЕГРАЦИЈА	434
Војкан Бижић	ВРСТЕ КАНАЛА КОМУНИКАЦИЈЕ КОЈЕ КОРИСТЕ СПОРТСКЕ ОРГАНИЗАЦИЈЕ	442
Snježana Vujičić	UTICAJ LIDERA NA ZALAGANJE ZAPOSLENIH I EFEKTIVNOST PREDUZEĆA	448

MEREC-COBRA approach in e-commerce development strategy selection

MEREC-COBRA приступ избору стратегије развоја е-трговине

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Abstract: The research objective of the paper is to propose a model, based on the Multiple-Criteria Decision-Making (MCDM) methods, that facilitates a selection process of an adequate strategy directed to the development of e-commerce. For that aim, the MEthod based on the Removal Effects of Criteria (MEREC) is applied for defining the criteria weights. The recently proposed COmprehensive Distance Based RAnking (COBRA) method is used for the final assessment and ranking of the considered alternatives. The applicability of the proposed model is tested by using an example borrowed from the literature. Three alternative development strategies are assessed against five evaluation criteria. The final results proved the applicability and reliability of the proposed MCDM model.

Keywords: MEREC method, COBRA method, development strategies, e-commerce, selection

Апстракт: Циљ рада је предлагање модела заснованог на методама Вишекритеријумског одлучивања (ВКО) које доприносе поједностављењу процеса селекције адекватне стратегије усмерене на развој е-трговине. У том циљу, метода под називом MEthod based on the Removal Effects of Criteria (MEREC) употребљена је за дефинисање тежина критеријума. Недавно предложена метода под називом COmprehensive Distance Based RAnking (COBRA) искоришћена је за коначну оцену и рангирање разматраних алтернатива. Применљивост предложеног модела проверена је на примеру који је преузет из литературе. Три алтернативне развојне стратегије оцењене су у односу на пет евалуационих критеријума. Финални резултати потврдили су применљивост и поузданост предложеног ВКО модела.

Кључне речи: MEREC метода, COBRA метода, развојне стратегије, е-трговина, избор

Introduction

An extensive range of online business activities that involve manipulating products and services represents electronic commerce or e-commerce. It can be stated that e-commerce is “usually associated with buying and selling over the Internet, or conducting any transaction involving the transfer of ownership or rights to use goods or services through a computer-mediated network.” (Gupta, 2014). The significance of e-commerce was especially revealed during the pandemic COVID-19. Three crucial obstacles that e-commerce faced during the pandemic are: 1) product availability; 2) logistics and transportation disruptions; and 3) consumer protection (Alfonso et al., 2021). In order to maintain proper functioning and retain consumer satisfaction, there is a need for applying adequate strategies for the development and enhancement of e-commerce.

The selection of the appropriate strategy is influenced by many criteria which exacerbate making a final choice. By introducing adequate mathematical models in the selection process, this problem could be overcome. The Multiple-Criteria Decision-Making (MCDM) methods impose as a suitable approach because they are convenient for application in conditions when existing many mutually conflicting criteria. Until now, many different MCDM approaches have been introduced, to mention some of the newly proposed: Combined Compromise Solution method (CoCoSo) (Yazdani et al., 2018), Full COnsistency Method (FUCOM) (Pamučar et al., 2018), Measurement of Alternatives and Ranking according to COmpromise Solution (MARCOS) (Stević et al., 2020), simple WeIghted Sum Product method (WISP) (Stanujkić et al., 2021). Proposed MCDM methods and models were used for problem solvation in different business fields (Lee & Chang, 2018; Rouyendegh et al., 2019; Stojčić et al., 2019; Štirbanović et al., 2019; Ture et al., 2019; Karabašević et al., 2020; Lin et al., 2020; Chowdhury & Paul, 2020; Tan et al., 2021; Sotoudeh-Anvari, 2022). Researchers and practitioners use the MCDM techniques to facilitate the decision process in the area of e-commerce as well (Alharbi & Naderpour, 2016; Aggarwal & Aakash, 2018; Sohaib et al., 2019; Li & Sun, 2020; Bączkiewicz, 2021a; Bączkiewicz et al., 2021b; Bączkiewicz et al., 2021c; Wang et al., 2021; Ziemba, 2021; Naseem et al., 2021a; Naseem et al., 2021b; Wu et al., 2021; Torre et al., 2022).

A model based on the recently introduced MEthod based on the Removal Effects of Criteria (MEREC) (Keshavarz-Ghorabae et al., 2021) and the COmprehensive Distance Based RAnking (COBRA) (Krstić et al., 2022) for selection of the appropriate development e-commerce strategy is proposed in this paper. The determination of the criteria weights is based on the MEREC method while the final assessment and ranking are performed by using COBRA method. The numerical example that illustrates the applicability of the proposed model is borrowed from the literature. To present the created model, the paper is organized as follows: Section 2 presents the explanation of the used methods; Section 3 contains numerical example; and in the end, the conclusion is given.

Methodology

The MEREC method

The MEREC method (Keshavarz-Ghorabae et al., 2021) enables defining of the objective weights of criteria because it uses input data for that matter. Although the MEREC method has been recently proposed, the researchers recognized its potential and used it for resolving various decision-making problems (Keshavarz-Ghorabae, 2021; Trung & Thinh, 2021; Rani et al., 2022; Ulutaş et al., 2022; Mishra et al., 2022; Ivanović et al., 2022). The computation procedure of the MEREC method involves the following steps.

Step 1. Form a decision matrix:

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1m} \\ x_{21} & x_{22} & \dots & x_{2j} & \dots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \dots & x_{ij} & \dots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \dots & x_{nj} & \dots & x_{nm} \end{bmatrix} \quad (1)$$

where x_{ij} is the performance rating of alternative i in relation to criterion j ($x_{ij} > 0$), n are alternatives and m are criteria.

Step 2. Normalize the decision matrix by using following Eq.:

$$n_{ij}^x = \begin{cases} \frac{\min_k x_{kj}}{x_{ij}} & \text{if } j \in B \\ \frac{x_{ij}}{\max_k x_{kj}} & \text{if } j \in C' \end{cases} \quad (2)$$

where n_{ij}^x represents elements of the normalized matrix N , B is the set of benefit criteria, and C is the set of cost criteria.

Step 3. Calculation of the overall performance of the alternatives as is shown:

$$S_i = \ln \left(1 + \left(\frac{1}{m} \sum_j |\ln(n_{ik}^x)|_{ij} \right) \right), \quad (3)$$

where S_i is the overall performance of the alternatives.

Step 4. Compute the alternatives' performances by removing each criterion in the following manner:

$$S_{ij} = \ln \left(1 + \left(\frac{1}{m} \sum_{k, k \neq j} |\ln(n_{ik}^x)|_{ij} \right) \right), \quad (4)$$

where S_{ij} denotes the overall performance of alternative i regarding the removal of criterion j .

Step 5. Compute the total of the absolute deviations. The removal effect of the criterion j is calculated as follows:

$$E_j = \sum_i |S_{ij} - S_i|, \quad (5)$$

where E_j represents the effect of removing criterion j .

Step 6. Define the overall criteria weights in the following way:

$$w_j = \frac{E_j}{\sum_k E_k}, \quad (6)$$

where w_j represents the weight of the criterion j .

The COBRA method

The COBRA method (Krstić et al., 2022) is recently proposed and because of that, the possibilities of this method are not examined yet. Until now, the COBRA method is mentioned in two papers regarding industry 4.0 and reverse logistics (Balázs et al., 2022; Fauzdar et al., 2022). The computation procedure of the COBRA method could be illustrated by a series of steps.

Step 1. Define a decision matrix in the way presented in the section regarding the MEREC method.

Step 2. Create the normalized decision matrix in the following way:

$$\Delta = [\alpha_{ij}]_{n \times m}, \quad (7)$$

where

$$\alpha_{ij} = \frac{a_{ij}}{\max_i a_{ij}}. \quad (8)$$

Step 3. Create the weighted normalized decision matrix Δ_w by using Eq. (9):

$$\Delta_w = [w_j \times \alpha_j]_{m \times n}, \quad (9)$$

where w_j denotes the relative weight of criterion j .

Step 4. Define the positive ideal (PIS_j), negative ideal (NIS_j), and average solution (AS_j) regarding each criterion function as follows:

$$PIS_j = \max_i (w_j \times \alpha_{ij}), \quad \forall j = 1, \dots, m \text{ for } j \in B, \quad (10a)$$

$$PIS_j = \min_i (w_j \times \alpha_{ij}), \quad \forall j = 1, \dots, m \text{ for } j \in C, \quad (10b)$$

$$NIS_j = \min_i (w_j \times \alpha_{ij}), \quad \forall j = 1, \dots, m \text{ for } j \in B, \quad (11a)$$

$$NIS_j = \max_i (w_j \times \alpha_{ij}), \quad \forall j = 1, \dots, m \text{ for } j \in C, \quad (11b)$$

$$AS_j = \frac{\sum_{i=1}^n (w_j \times \alpha_{ij})}{n}, \quad \forall j = 1, \dots, m \text{ for } j \in B, C, \quad (12)$$

where B is the set of benefit and C is the set of cost criteria.

Step 5. In this step, the distance from the positive ideal ($d(PIS_j)$) and negative ideal ($d(NIS_j)$) solutions should be defined. Also, the positive ($d(AS_j^+)$) and negative distances ($d(AS_j^-)$) from the average solutions should be determined. This procedure is performed in the following way:

$$d(S_j) = dE(S_j) + \sigma \times dE(S_j) \times dT(S_j), \quad \forall j = 1, \dots, m, \quad (13)$$

where S_j is any solution (PIS_j, NIS_j or AS_j), σ represents the correction coefficient defined by using the following Eq.:

$$\sigma = \max_i dE(S_j)_i - \min_i dE(S_j)_i, \quad (14)$$

where $dE(S_j)_i$ and $dT(S_j)_i$ represents the Euclidian and Taxicab distances, respectively, which are calculated for the positive ideal solution calculated in the following way:

$$dE(PIS_j)_i = \sqrt{\sum_{j=1}^m (PIS_j - w_j \times \alpha_{ij})^2}, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m, \quad (15)$$

$$dT(PIS_j)_i = \sum_{j=1}^m |PIS_j - w_j \times \alpha_{ij}|, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m. \quad (16)$$

For the negative ideal solutions, the Euclidian and Taxicab distances are obtained in the following way:

$$dE(NIS_j)_i = \sqrt{\sum_{j=1}^m (NIS_j - w_j \times \alpha_{ij})^2}, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m, \quad (17)$$

$$dT(NIS_j)_i = \sum_{j=1}^m |NIS_j - w_j \times \alpha_{ij}|, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m. \quad (18)$$

For the positive distance from the average solution the Euclidian and Taxicab distances are calculated as follows:

$$dE(AS_j)_i^+ = \sqrt{\sum_{j=1}^m \tau^+ (AS_j - w_j \times \alpha_{ij})^2}, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m, \quad (19)$$

$$dT(AS_j)_i^+ = \sum_{j=1}^m \tau^+ |AS_j - w_j \times \alpha_{ij}|, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m. \quad (20)$$

$$\tau^+ = \begin{cases} 1 & \text{if } AS_j < w_j \times \alpha_{ij} \\ 0 & \text{if } AS_j > w_j \times \alpha_{ij} \end{cases} \quad (21)$$

Finally, for the negative distance from the average solution the Euclidian and Taxicab distances are calculated in the following manner:

$$dE(AS_j)_i^- = \sqrt{\sum_{j=1}^m \tau^- (AS_j - w_j \times \alpha_{ij})^2}, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m, \quad (22)$$

$$dT(AS_j)_i^- = \sum_{j=1}^m \tau^- |AS_j - w_j \times \alpha_{ij}|, \quad \forall i = 1, \dots, n, \quad \forall j = 1, \dots, m. \quad (23)$$

$$\tau^- = \begin{cases} 1 & \text{if } AS_j > w_j \times \alpha_{ij} \\ 0 & \text{if } AS_j < w_j \times \alpha_{ij} \end{cases} \quad (24)$$

Step 6. Rank the considered alternatives in ascending order based on the comprehensive distances (dC_i) which is defined by using:

$$dC_i = \frac{d(PIS_j)_i - d(NIS_j)_i - d(AS_j)_i^+ + d(AS_j)_i^-}{4}, \forall i = 1, \dots, n. \quad (25)$$

Numerical example

In this section, the applicability of the proposed model will be illustrated by using an example regarding the selection of the e-commerce development strategies borrowed from the paper of Stanujkic et al. (2019). Three strategies are submitted under evaluation and they are:

- A_1 – E-customization and personalization
- A_2 – Social e-commerce adoption model
- A_3 – Strong search engine optimization – SEO

The considered strategies are evaluated against the following set of criteria:

- C_1 – The implementation of the strategy feasibility
- C_2 – The speed of implementation
- C_3 – Compliance with the corporate strategy
- C_4 – Compliance of strategy with the mission and vision of the organization and
- C_5 – General acceptance

All criteria involved in the decision process are of benefit type.

Decision-making involved one decision-maker and his ratings are presented in **Table 1**.

Table 1. Decision-makers` ratings of the alternative strategies

	C_1	C_2	C_3	C_4	C_5
A_1	3	3	3	2	2
A_2	5	4	5	5	5
A_3	3	3	4	5	5

Source: Stanujkic et al., 2019

Criteria weights are obtained by using the MEREC method and Eqs. (1)-(6) and they are presented in **Table 2**.

Table 2. The criteria weights

	w_j
C_1	0.097
C_2	0.056
C_3	0.153
C_4	0.347
C_5	0.347

Source: Authors` calculation

As **Table 2** shows, the criteria C_4 – *Compliance of strategy with mission and vision of the organization* and C_5 – *General acceptance* have the same highest weight among the considered criteria.

Now, the COBRA method is applied to achieve the final result and ranking order of the considered alternative strategies. The computation is performed by using Eqs. (7)-(25). The obtained results and ranking order of the e-commerce development strategies are presented in **Table 3**.

Table 3. The results gained by applying the COBRA method

	$d(PIS)$	$d(NIS)$	$d(AS^+)$	$d(AS^-)$	dC	Rank
A_1	0.35242	0.00000	0.0000	0.2121	0.1411	3
A_2	0.00000	0.35242	0.1087	0.0000	-0.1153	1
A_3	0.05266	0.33619	0.0996	0.0138	-0.0923	2

Source: Authors` calculation

The results show that the optimal strategy for application in the existing conditions is strategy A_2 – *Social e-commerce adoption model* while the least adequate is strategy A_1 – *E-customization and personalization*.

Conclusion

The main goal of this paper was to introduce a new MCDM model suitable for the assessment and selection of e-commerce development strategies. For that purpose, two recently proposed techniques were used. The first one, called MEREC, was used for defining the criteria weights, while the second one, the COBRA method, was applied for the estimating and ranking of the considered alternative strategies. The applicability of the proposed model was verified by the numerical example retrieved from the literature. The obtained results confirmed the usefulness of the proposed approach. Namely, in the paper of Stanujkic et al. (2019), from whom the example is borrowed, in the first place is positioned the alternative A_2 – *Social e-commerce adoption model*. The second-ranked is the alternative A_3 – *Strong search engine optimization – SEO*. Alternative A_1 – *E-customization and personalization* has third, the worst position. The same ranking order is obtained in this case as well, although Stanujkic et al. (2019) give the same significance to all evaluation criteria. This result confirms the applicability and reliability of the proposed approach for application in decision-making in the e-commerce field as well as in other business areas.

The main shortage of paper is the involvement of only one decision-maker in the decision process which possibly leads to a biased result. By engaging more experts, the results and final ranking order would be more representative and real. Besides, the model is applied to the hypothetical example borrowed from the other authors. The potential of the MEREC-COBRA model as well as the potential of each method separately should be further examined and used for resolving real-world problems. Propositions for future research also go in direction of creating and introducing adequate extensions that will further extend the possibilities of these methods.

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330.341.1(082)(0.034.2)
330(082)(0.034.2)

МЕЂУНАРОДНА научно-стручна конференција МЕФкон Иновације као покретач развоја (2022 ; Београд)

Зборник радова са међународног скупа [Електронски извор] / Међународна научно-стручна конференција МЕФкон 2022 Иновације као покретач развоја, [Београд, 1. децембар 2022. године] ; [организатор Факултет за примењени менаџмент, економију и финансије ... и др.] = International conference proceedings / International scientific & professional conference MEFkon 2022 Innovation as the Initiator of Development, [Belgrade, December 1st 2022] ; [organizer Faculty of Applied Management, Economy and Finance ... et al.] ; [уредници, editors Darjan Karabašević, Svetlana Vukotić, Gabrijela Popović]. - Београд : Факултет за примењени менаџмент, економију и финансије = Belgrade : Faculty of Applied Management, Economy and Finance, 2022 (Београд : Факултет за примењени менаџмент, економију и финансије = Belgrade : Faculty of Applied Management, Economy and Finance). - 1 електронски оптички диск (DVD) : текст, слика ; 12 cm

Системски захтеви: Нису наведени. - Тираж 100. - Предговор / уредници = Foreword / editors. - Библиографија уз сваки рад. - Abstracts.

ISBN 978-86-84531-59-1

а) Иновације -- Технолошки развој -- Зборници б) Знање -- Економија -- Зборници в) Предузећа -- Пословање -- Информациона технологија -- Зборници г) Одрживи развој -- Зборници д) Економија -- Зборници

COBISS.SR-ID 82461705