Endüstri Mühendisliği / Journal of Industrial Engineering 34(2), 243-275, 2023

Endüstri Mühendisliği / Journal of Industrial Engineering

https://dergipark.org.tr/tr/pub/endustrimuhendisligi

SELECTION OF SOCIAL MEDIA PLATFORMS: A NEW HYBRID MULTI-CRITERIA DECISION MAKING APPROACH

Selen AVCI AZKESKİN[1] Melike Kübra EKİZ BOZDEMİR[2*], Atakan ALKAN[3]

[1]Kocaeli Üniversitesi Mühendislik Fakültesi, Endüstri Mühendisliği Bölümü, KOCAELI ORCID No : http://orcid.org/0000-0001-7433-5696

[2]Kocaeli Üniversitesi Mühendislik Fakültesi, Endüstri Mühendisliği Bölümü, KOCAELI ORCID No : http://orcid.org/0000-0003-3340-0484

[3]Kocaeli Üniversitesi Mühendislik Fakültesi, Endüstri Mühendisliği Bölümü, KOCAELI ORCID No : http://orcid.org/0000-0003-3899-2829

Keywords

ANP
COPRAS
GRA
FA
Selection of Social Media Platforms (SMPs)

Abstract

Social Media Platforms (SMPs) are highly interactive platforms where individuals and communities engage in sharing, discussing, and collaborating on ideas, information, videos, photos, and more. With millions of online users, these platforms significantly influence one another's behavior, attitudes, and habits. SMPs are widely used in various domains such as advertising, client relations, tourism, and travel by both individual users and organizations. Therefore, the selection of SMPs becomes a critical Multi Criteria Decision-Making (MCDM) problem. This study focuses on the selection and ranking of SMPs from the perspective of undergraduate students, who represent one of the most active and influenced age groups. Furthermore, we aim to analyze the impact of MCDM methods and criteria weights on the selection and ranking process, employing five different approaches: Factor Analysis (FA) combined with Analytical Network Analysis (ANP) (FA&ANP), FA combined with Complex Proportional Assessment (COPRAS) (FA&COPRAS), ANP&COPRAS, FA

*Sorumlu yazar; e-posta: melike.ekiz@kocaeli.edu.tr

doi : https://doi.org/10.46465/endustrimuhendisligi.1259667

combined with Grey Relations Analysis (GRA) (FA&GRA), and ANP&GRA. By utilizing these approaches, we aim to evaluate the most significant criteria and preferred SMPs. Furthermore, it is worth noting that the findings of this study will provide valuable insights for policymakers in terms of updating or adding new features to SMPs, thereby guiding their decision-making process.

SOSYAL MEDYA PLATFORMLARININ SEÇİMİ: YENİ BIR HİBRİT ÇOK KRİTERLİ KARAR VERME YAKLAŞIMI

Anahtar Kelimeler

ANP
COPRAS
GRA
FA
Sosyal Medya Platformu (SMP) Seçimi

Öz

*Sosyal Medya Platformları (SMP), bireylerin ve toplulukların birbirleriyle video, fotoğraf vb. paylaştığı, fikir ve bilgi alışverişinde bulunduğu, tartıştığı, işbirliği yaptığı platformlardır. Milyonlarca kullanıcı bu platformlar aracılığıyla çevrimiçi ortamda birbirleriyle etkileşim kurarak birbirlerinin davranışlarını, tutumlarını, alışkanlıklarını önemli ölçüde etkileyebilirler. SMP'ler, bireysel kullanıcıların yanı sıra kuruluşlar tarafından da reklam, satış, müşteri ilişkileri yönetimi vb. birçok alanda kullanılmaktadır. Bu nedenle, SMP seçimi önemli bir Çok Kriterli Karar Verme (ÇKKV) problemi olarak ele alınabilir. Bu çalışmada, SMP'lerin seçimi ve sıralamasında SMP'leri aktif şekilde kullanan ve SMP'lerde üretilen içeriklerden fazlasıyla etkilenen yaş grubu olarak lisans öğrencilerinin görüşleri dikkate alınmıştır. Ayrıca hem farklı ÇKKV yöntemlerinin hem de kriterlere atanan ağırlıkların seçim ve sıralamaya etkisini analiz edebilmek amacıyla Faktör Analizi (FA) ve Analitik Ağ Analizi (ANP)-FA&ANP, FA ve Karmaşık Nisbi Değerlendirme (COPRAS)-FA&COPRAS, ANP&COPRAS, FA ve Gri İlişkisel Analiz (GRA)-FA&GRA ile ANP&*GRA *olmak üzere 5 farklı yaklaşım kullanılmıştır. Böylece daha çok tercih edilen SMP'ler ve SMP seçiminde etkili olan kriterler değerlendirilmiştir. Çalışmanın, yeni SMP fikirleri veya var olan SMP'lere yeni özellikler eklenmesi konusunda yol gösterici olacağı düşünülmektedir.*

Araştırma Makalesi		Research Article	
Başvuru Tarihi	: 03.03.2023	Submission Date	: 03.03.2023
Kabul Tarihi	: 23.07.2023	Accepted Date	: 23.07.2023

1. Introduction

Social media encompasses various platforms such as collaborative projects, blogs, microblogs, social networking sites, content communities, virtual game worlds, and virtual social worlds. Some notable examples of social media platforms include Wikipedia, Twitter, Facebook, YouTube, Instagram, and WhatsApp (Kaplan and Haenlein, 2012). In this study, we have focused on the evaluation of selected Social Media Platforms (SMPs), namely WhatsApp, Myspace, Instagram, Foursquare, WeChat, Google+, Webio, Snapchat, Facebook, Friendfeed, Tumblr, Twitter, Pinterest, YouTube, and LinkedIn. These platforms have garnered significant global downloads, and some of them are particularly popular in densely populated regions such as China, Japan, and Korea in the Far East. However, it is important to note that the popularity of these applications may fluctuate over time. These SMPs serve various purposes, including communication with individuals, information gathering, staying updated with current events, exploring personal interests, sharing photos and videos, establishing a professional presence, leisure activities, posting about hobbies, checking in at locations, and discovering nearby restaurants and cafes (Li and Bernoff, 2008; Hayes, Ruschman, and Walker, 2009; Constantinides and Stagno, 2012; Bozdemir and Alkan, 2022) .

Nowadays, a wide range of SMPs exist, each serving different purposes such as customer relationships, sales policies, market research, and influencing society. These SMPs need to continuously update themselves and introduce new features to maintain their popularity and stay competitive in the market. Therefore, our study focuses on analyzing the features of different SMP alternatives that are commonly used in general. Additionally, we investigate which SMPs stand out based on the identified criteria. Consequently, this study aims to provide valuable insights for policy makers in the development and improvement of SMPs based on user preferences. In this study, we approached the selection of SMPs as a Multi-Criteria Decision Making (MCDM) problem. We identified 14 criteria and selected 15 SMPs that have been extensively studied and widely downloaded. We adopted five different approaches to address the problem of identifying the most significant criteria and ranking SMPs. The initial approach involved combining Factor Analysis (FA) with Analytical Network Analysis (ANP). FA was utilized to establish the network structure of ANP by clustering the criteria. ANP was chosen due to its capability to consider the interdependencies among criteria when determining their weights. These weights were computed based on the relationships identified through FA. Additionally, we examined the feasibility of employing the factor loads obtained from FA for criteria weights. For ranking purposes, Grey Relations Analysis (GRA) and Complex Proportional Assessment (COPRAS) were applied. GRA proved to be effective in addressing decision problems characterized by intricate relationships among factors, while COPRAS served as a suitable method for comparisons due to its ability to generate accurate assessments through straightforward calculations.

The first approach, FA combined with ANP, allowed us to establish the network structure of ANP through the utilization of FA for criteria clustering. Furthermore, ANP was employed to calculate the criteria weights and perform the ranking, eliminating the need for additional weight calculation methods. In the second approach, factor loads obtained from FA were used as weights, and SMPs were ranked using COPRAS in the FA&COPRAS framework. In the third approach, ANP was used to calculate the criteria weights, and SMPs were ranked using COPRAS in the ANP&COPRAS framework. In the fourth approach, factor loads obtained from FA were utilized as weights, and SMPs were ranked using GRA in the FA&GRA framework. Lastly, in the fifth approach, ANP determined the criteria weights, and SMPs were ranked using GRA in the ANP&GRA framework.

This paper is organized as follows. In Section 2 reviews literature on social media, SMPs, and MCDM methods. In Section 3 describes the methodology used in the study and Section 4 contains evolution of alternatives by these 5 approaches. Finally, Section 5 presents results and conclusions.

2. Literature Review

Nowadays, social media plays a crucial role in customer relationship management, analysis, and addressing customer complaints for companies, institutions, and organizations. It serves as a platform for various marketing strategies, including advertising, product presentations, and promotions. It enables companies to effectively communicate with their customers, promote their products, and enhance customer loyalty. However, the presence of dissatisfied customers who express their grievances publicly and the potential impact of misleading or false comments pose challenges. Consequently, the concept of "Social Media Marketing" has emerged, leading companies to put significant effort into managing their communication on SMPs (Kaur, 2016). Therefore, it is crucial for companies to prioritize effective social media communication and management (Saravanakumar and SuganthaLakshmi, 2012). Additionally, SMPs have proven to be highly valuable and effective tools for small business entrepreneurs, facilitating product and service advertising, creating fan pages for followers, and receiving valuable suggestions and feedback for business improvement (Shabbir, Ghazi, and Mehmood, 2016).

According to the literature, SMPs have found applications in various fields. Government agencies utilize SMPs as a means of communication with their constituents, facilitating the exchange of information, feedback, and public engagement (Gensler, Völckner, Liu-Thompkins, and Wiertz, 2013). In the field of education, faculty members incorporate SMPs into their teaching practices to enhance students' learning outcomes and satisfaction by promoting active engagement, collaboration, and resource sharing (Picazo-Vela, Gutiérrez-

Martínez, and Luna-Reyes, 2012). Additionally, SMPs have proven to be valuable tools in emergency management, enabling the rapid dissemination of news, warnings, and critical information to a wider audience in a shorter time, contributing to effective crisis communication and response (Cao, Ajjan, and Hong, 2013; Luna and Pennock, 2018).

Various social media mechanisms are commonly used, including product or service review websites, blogs, chat rooms, discussion boards, and well-known SMPs such as Facebook, Twitter, Instagram, Snapchat, LinkedIn, Google+, and YouTube (Oralhan, 2019; Kaplan and Haenlein, 2010). Pinterest, a fast-growing SMP, is popular among users for creating collections related to hobbies, sports, and fashion (Hall and Zarro, 2012; Gilbert, Bakhshi, Chang, and Terveen, 2013). Among instant messaging SMPs, WhatsApp stands out as the most preferred platform, although there are many other options available for mobile devices (Cetinkaya, 2017). In recent years, several location-sharing SMPs have emerged, with Foursquare gaining prominence due to its large user base (Lindqvist, Cranshaw, Wiese, Hong, and Zimmerman, 2011). Weibo, a microblogging platform, has gained significant popularity in China, which has the largest number of internet users globally (Chen, Zhang, Lin, and Lv, 2011), while WeChat has become a widely used communication application in China since the 2010s (Gao and Zhang, 2013). However, some SMPs have experienced a decline in popularity over the years. Friendfeed, once recognized for its rich features, has lost its prominence (Celli, Di Lascio, Magnani, Pacelli, and Rossi, 2010), Tumblr, a microblogging platform, was previously one of the most popular platforms (Chang, Tang, Inagaki, and Liu, 2014), and Myspace was the most visited site by US web users in the early 2000s (Thelwall, 2009).

The remainder of this section includes some papers from literature which are about social media and MCDM methods. Firstly, we have reviewed that analysing the criteria for social media and SMPs. Hung et al. (2012) conducted an analysis of the criteria influencing Online Reputation Management (ORM), an essential tool in social media marketing. They employed the Decision-Making Trial and Evaluation Laboratory (DEMATEL) -based Analytic Network Process (DANP) to assess these criteria. The identified criteria included centralized reputation systems, distributed reputation systems, and the influence of reputation management on customer relationships, employees, and social responsibility. Oralhan (2019) determined the selection of SMPs' criteria, which used by a company in the telecommunication sector to be preferred for advertising, calculated the effect levels of the criteria with the Fuzzy DEMATEL method. Consequently, he stated that the three most important criteria were view rate, view and perception, and member profile. Secondly, we have reviewed selection of an effective media mix with MCDM and optimization techniques. Javan, Khanlari, Motamedi, and Mokhtari (2018) identified attention, interest, desire, and action as the criteria for selecting the best advertising media using the Analytic Hierarchy Process (AHP) and Genetic Algorithm (GA). The alternatives considered for this selection included TV, radio, billboards, newspapers, posters, the internet, and ATMs. Salleh, Ismail, and Abdullah (2021) identified cost per advertisement, preparation 1, preparation 2, operating expenditure, and targeted audience number as criteria for selecting an effective media mix to achieve maximum performance in promoting skills training programs using integer programming. The alternatives considered for this selection included roadshow, TV slot, radio advertisement, printed media, and social media. According to Sharma and Joshi (2019), the criteria for determining the optimal media mix for IEC campaigns included command attention, maximum reach, communicate the benefit, build connection, call for an action. The alternatives considered for this media mix consisted of newspapers, radio, TV, internet, wall painting, live events, and hoardings. The selection process employed a combination of AHP and fuzzy linguistic GA. According to Ackora-Prah, Owusu, and Haabilla (2018), the criteria for optimizing media selection in a company were identified as cost, estimated audience exposure, and media advertising. The alternatives considered for this selection model included television media, print media, and radio media. The model employed linear programming techniques to determine the optimal media mix for the company. Thirdly, we conducted a review on the selection of SMPs, such as Facebook, Twitter, Instagram, and others. Sudipa et al. (2020) used The Preference Ranking Organization Method for Enrichment Evaluation II (PROMETHEE I)I to select the best SMP for online businesses based on criteria which are security, application features, community, ease of access, and response speed. The alternatives is Facebook, Instagram, Line, and WhatsApp. Hanum, Sucahyo, and Gandhi (2021) employed AHP and COPRAS methods to analyze communication media rankings for socialization support at PPATK. The criteria are attention, interest, search, desire, action, like/dislike, share, and love/hate. The alternatives are website, Facebook, Twitter, and Instagram. Lastly, we conducted a comprehensive review focusing on a specific application, examining its features, and functionality. Wu, Chang, and Liao (2020) developed a hybrid MCDM model using fuzzy Delphi, DEMATEL, ANP, and TOPSIS methods to select the most suitable variety show hosts in the context of social media. The study categorized the criteria into four perspectives: person, profession, program, and promotion. Under the "promotion" perspective, the criteria included the hosts' online presence on YouTube (views and subscriptions), Facebook (fans and posts shared), and Instagram (fans). Muruganantham and Gandhi (2016) used Elimination and Choice Translating Reality English (ELECTRE), PROMETHEE, AHP, SDI Matrix Method, Pugh or Decision Matrix Method and TOPSIS to discover and rank influential users on Facebook. The selection was conducted on 20 influencers, considering criteria such as betweenness centrality, closeness centrality, eigenvector centrality, and PageRank. Wu, Chang, Chuang, Chen, and Tsai (2022) employed fuzzy Delphi, DEMATEL, ANP, and TOPSIS methods for the identification and selection of YouTubers for hotels. The study evaluated three YouTubers based on their personal content, production quality, and marketing effectiveness. These methods provided a comprehensive framework for assessing and ranking the suitability of YouTubers in the context of hotel marketing. Lin, Shih, Tzeng, and Yu (2016) employed DEMATEL, Principal Component Analysis (PCA), ANP, and Vlse Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR) methods to develop a selection model for digital music service platforms. The evaluation of the platforms included four criteria: music search & recommendation, platform design & maintenance, platform functionality of the website, and pricing & promotion, as well as platform image & customer relations. Erol, Oztel, Searcy, and Medeni (2023) employed the extent analysis-based rough AHP (RAHP-E) and rough compromise programming (RCP) methods for the selection of the most suitable blockchain platform. The findings of the literature review are summarized in Table 1.

Based on the literature review, it was observed that the evaluation of SMPs was relatively limited, with a small number of SMPs being considered. However, the present study aimed to address this limitation by including a wider range of SMPs for evaluation. In this study, we investigated that the the question of which SMPs are preferred based on their features in general use.

Table 1

Findings of The Literature Review

Contributor(s)	Purpose	Methods	Criteria	Alternatives
Hung et al. (2012)	Analysinf of the criteria impacting ORM, which is an important tool of social media marketing	-DEMATEL -DANP	-Centralized reputation systems -Distributed reputation systems -Customer relationships -Employees -Social responsibility	-
Oralhan (2019)	Determining and influence of criteria and calculating their weights for selection of SMPs	-Fuzzy DEMATEL	-Perception -Contents -Cost -Member profile -Impression rate -Technical support	-
Sudipa et al. (2020)	Selection of the best SMP for online businesses	-PROMETHEE II	-Security -Application features -Community -Ease of access -Response speed	-Facebook -Instagram -Line -WhatsApp
Hanum et al. (2021)	Communication media rankings to support socialization at PPATK	-AHP -COPRAS	-Attention -Interest -Search -Desire -Action -Like/dislike -Share -Love/hate	-Website -Facebook -Twitter -Instagram
Javan et al. (2018)	Selection of the best advertising media	-AHP -Genetic Algorithm (GA)	-Attention -Interest -Desire -Action	-Tv -Radio -Billboord -Newspaper

				-Poster -Internet -ATM
Salleh et al. (2021)	Selection of an effective media mix	-Integer Programming	-Cost per advertisement -Preparation 1 -Preparation 2 -Operating expenditure -Targeted audience number	-Roadshow -TV slot -Radio advertisement -Printed media -Social media
Sharma and Joshi (2019)	Optimal media mix for IEC campaigns	-AHP -Fuzzy Linguistic GA	-Command attention -Maximum reach -Communicate the benefit -Build connection -Call for an action	-Newspapers -Radio -Tv -Internet -Wall painting -Live events -Hoardings
Ackora-Prah et al. (2018)	Optimal media selection model for a company	-Linear Programming	-Cost -Estimated audience exposure -Media advert	-Television Media -Print Media -Radio Media
Wu et al. (2020)	Selection of the optimal variety show hosts	-Fuzzy Delphi -DEMATEL -ANP -TOPSIS	-Familiarity -Likeability -Attitude -Expression -Emotion -Response -Experience -Cost -Views of the host's YouTube channel -The number of people in the host's Facebook fan page -The number of fans in the host's Instagram	Hosts defined as A_1, A_2 and A_3

Muruganantham and Gandhi (2016)	Ranking influential users on Facebook	-ELECTRE -PROMETHEE -AHP -SDI Matrix Method -Decision Matrix Method - TOPSIS	-Betweenness centrality -Closeness centrality -Eigenvector centrality, -PageRank	20 influencers
Wu et al. (2022)	Identification and selection of YouTubers for hotels	-Fuzzy Delphi -DEMATEL -ANP -TOPSIS	-Personal -Content -Production -Marketing	YouTubers defined as A_1, A_2 and A_3
Lin et al. (2016)	Selection model for digital music service platforms	-DEMATEL -Principal Component Analysis (PCA) -ANP -Vlse Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR)	-Music search & recommendation -Platform design & maintenance -Platform functionality of website -Pricing & promotion -Platform image & customer relations	Music platforms defined as A_1, A_2, A_3 and A_4
Erol et al. (2023)	Selecting the most suitable blockchain platform	-Extent Analysis-based Rough AHP (RAHP-E) -Rough Compromise Programming (RCP)	-Security -Interoperability -Community support -Business reputation and resiliency -Multi-functionality -Developer availability - Capacity -Scalability -Throughput -Latency	-Ethereum -Binance Coin - Cardano - Palkadot - Vechain - Chainlink - Solana - Tron - Neo - Eos

3. Methodology

In this study, research and publication ethics were complied with (Science and Engineering Sciences Ethics Committee, 11/11/2020, no 13). In this section, we provide a detailed description of our methodology. Firstly, we identified 14 criteria based on a thorough review of the literature. We also selected 15 SMPs that have been extensively studied and are widely downloaded. Subsequently, we conducted a survey among undergraduate students to collect relevant data. Using the gathered data, we employed Factor Analysis (FA) to group the criteria into main clusters, allowing for a more organized analysis. FA helped us identify the interdependencies among the criteria and establish meaningful relationships. By employing this methodology, we ensured a systematic and rigorous approach to our study, allowing us to obtain reliable and valuable insights into the selection and ranking of SMPs.ANP enables consideration of dependencies and feedback in decision problems. In this study, the assumption that criteria influence each other has been confirmed through FA, and therefore, ANP has been used for criteria weighting instead of methods such as Analytic Hierarchy Process (AHP), Step-Wise Weight Assessment Ratio Analysis (SWARA), or Entropy. Additionally, FA has been used as a criteria weighting method in order to investigate whether the factor loadings calculated with FA can be used for weighting in decision problems. Grey Relational Analysis (GRA) is a ranking, classification, and decision-making technique based on the Grey System Theory. GRA is an effective solution method that can be applied to decision problems with complex relationships among factors. On the other hand, COPRAS can be preferred over methods such as AHP, VIKOR, or PROMETHEE due to its ease of mathematical calculations and ability to make accurate evaluations with a simple approach. In this study, these two methods have been used as ranking methods, and their impacts on ranking have been compared. Accordingly, we employed five different approaches to address the problem of determining the most important criteria for SMPs, as well as ranking and selecting them. These approaches are illustrated in Figure 1. In the first approach, FA&ANP, we utilized FA to obtain the network structure of ANP, which was then used for clustering the criteria. Additionally, ANP was employed to calculate the weights of the criteria and perform the ranking of SMPs. In the second approach, FA&COPRAS, we used the factor loads obtained from FA as weights, and COPRAS was employed to rank the SMPs. In the third approach, ANP&COPRAS, the ANP was utilized to calculate the criteria weights, while the COPRAS was used for ranking the SMPs. In the fourth approach, FA&GRA, the factor loads obtained from FA were employed as weights, and GRA was utilized to rank the SMPs. Lastly, in the fifth approach, ANP&GRA, the ANP was employed to calculate the criteria weights, and the GRA was utilized to rank the SMPs.

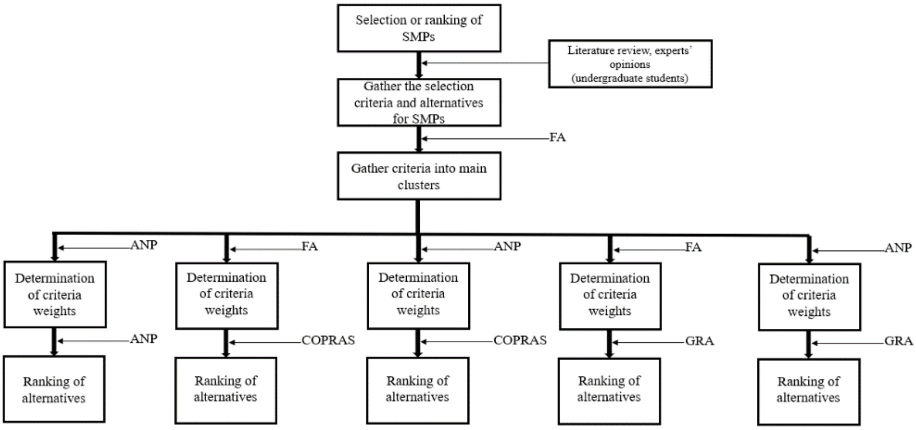

Figure 1. Flow Chart Of Methodology

3.1. Determination of Alternatives

In our study, we have aimed to investigate which SMP stands out with which feature. Although SMPs are thought to be quite different from each other, they share common aspects in terms of usage purposes. For example, while sending and receiving messages is the most basic feature of WhatsApp, it is also possible on other platforms like Facebook, Twitter, MySpace, Instagram, and Snapchat. Additionally, it is possible to communicate through comments on platforms such as YouTube, LinkedIn, and Pinterest, apart from direct conversation. Another example is that while LinkedIn is most commonly used to find jobs, businesses sometimes post job openings on their Instagram and Facebook pages as well. Furthermore, while Foursquare is primarily used for location sharing, other platforms such as Instagram, Twitter, Facebook, and Pinterest can also be utilized for this purpose. Therefore, the most preferred SMPs evaluated as alternatives, supported by studies in the literature. As mentioned briefly in the previous section, these are WhatsApp (A_1), Myspace (A_2), Instagram (A_3), Foursquare (A_4), WeChat (A_5), Google+ (A_6), Webio (A_7), Snapchat (A_8), Facebook (A_9), Friendfeed (A_{10}), Tumblr (A_{11}), Twitter (A_{12}), Pinterest (A_{13}), YouTube (A_{14}) and LinkedIn (A_{15}) where $i = 1, \dots, n$ as alternatives.

3.2. Determination of Criteria

After conducting a literature review, we identified 14 criteria (Li and Bernoff, 2008; Hayes et al., 2009; Constantinides and Stagno, 2012). These criteria are: look or upload photos (C_1), watch or share video (C_2), place notification (check in) (C_3), send or receive messages (C_4), communicate with community, group, etc. (C_5), follow the agenda (C_6), have information about events or persons (C_7), access to contact information (C_8), spend your free time (C_9), use to have fun or to relax (C_{10}), access to information (searching) (C_{11}), use for personal presentation or information purposes (C_{12}), keep in touch with friends (C_{13}), make new friends and to communicate with them (C_{14}) where $j = 1, \dots, m$ as criteria. The whole of criteria is intended to be maximized.

3.3. Determination of Decision Matrix

We asked a total of 109 undergraduate students, 46 of whom were male and 63 were female, to evaluate all alternatives according to all criteria on a 1-5 scale. Among the students, 30 were 1st grader, 30 were 2nd grader, 25 were 3rd grader, and 24 were 4rd grader. For example, "How often do you use WhatsApp (A_1) for looking or uploading photos (C_1)? '1' indicates never use, '5' indicates always use." When conducting a reliability analysis for the survey, it was calculated that the Cronbach's Alpha value is within the 95% confidence interval of [.953, .982]. Then, we calculated the geometric mean of all scores assigned to an alternative on a criteria basis. Because, geometric mean is commonly used when calculating the average of percentages, rates, and indices. Additionally, according to Saaty (2008), the geometric mean method is the only way to combine judgments. Accordingly, the decision matrix we have determined is as in Table 2.

3.4. Methods

3.4.1 Factor Analysis (FA)

In this step, we grouped the criteria via FA which is used to transform interrelated data into independent and fewer new data groups, and group variables (Tok, Görentaş, and Avcı, 2021). The conformity of the data for FA has confirmed using the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett Sphericity tests which are 0.856, and also significant ($\chi 2$ = 693.160; p<0.001), respectively. As a result of FA, two factors have eigenvalues greater than 1 and the total variance of them is 95.153. Therefore, 14 criteria could be grouped into 2 clusters and the pattern matrix is determined according to FA in Table 3. According to the pattern matrix, C_{10}, C_2, C_{11}, C_9, C_6 and C_7 are in Cluster 1, and C_3, C_4, C_{13}, C_5, C_8 and C_{14} are in Cluster 2. Although, C_{12} and C_1 seem to be in the 1st cluster, it is clear that they are also related to the 2nd cluster, and therefore Table 3 shows that there are very little differences between factor loads. We have called Cluster 1 "Entertainment and Information" and Cluster 2 "Communication".

Table 2
Decision Matrix

	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}
C_1	3.16	1.05	3.29	1.05	1.03	1.50	1.04	1.68	1.25	1.03	1.08	2.37	1.40	2.11	1.45
C_2	2.77	1.03	3.29	1.04	1.03	1.27	1.03	1.57	1.20	1.03	1.04	2.33	1.21	3.67	1.39
C_3	1.91	1.04	1.67	1.08	1.04	1.10	1.04	1.27	1.06	1.04	1.04	1.12	1.06	1.07	1.12
C_4	4.55	1.04	3.18	1.04	1.04	1.21	1.04	1.60	1.17	1.04	1.04	1.88	1.06	1.09	1.35
C_5	3.99	1.04	2.67	1.03	1.03	1.15	1.03	1.31	1.23	1.04	1.04	1.88	1.09	1.34	1.43
C_6	2.41	1.04	2.87	1.03	1.03	1.46	1.03	1.12	1.27	1.03	1.03	3.21	1.07	2.28	1.43
C_7	2.80	1.05	3.18	1.04	1.03	1.43	1.03	1.28	1.34	1.04	1.04	2.86	1.11	2.21	1.64
C_8	3.08	1.06	2.30	1.06	1.03	1.45	1.03	1.19	1.39	1.04	1.06	1.82	1.06	1.36	1.73
C_9	3.11	1.04	3.41	1.03	1.03	1.32	1.04	1.44	1.23	1.03	1.06	2.62	1.26	3.49	1.48
C_{10}	2.63	1.06	3.40	1.05	1.04	1.21	1.04	1.59	1.26	1.05	1.07	2.37	1.34	3.55	1.28
C_{11}	2.52	1.05	2.21	1.03	1.03	1.85	1.05	1.13	1.20	1.03	1.05	2.64	1.12	2.67	1.59
C_{12}	2.49	1.04	1.89	1.03	1.03	1.49	1.04	1.13	1.15	1.04	1.03	1.76	1.11	1.86	1.55
C_{13}	4.40	1.04	3.28	1.05	1.03	1.14	1.03	1.57	1.38	1.03	1.05	1.97	1.07	1.19	1.43
C_{14}	2.36	1.03	2.56	1.04	1.05	1.05	1.03	1.27	1.22	1.03	1.05	1.77	1.07	1.12	1.43

Table 3
Pattern Matrix

Criteria		1- Entertainment and Information	2- Communication	Criteria		1- Entertainment and Information	2- Communication
C_{10}	use to have fun or to relax	1.02144		C_3	place notification (check in)		-1.05088
C_2	watch or share video	1.01780		C_4	send or receive messages		-1.03836
C_{11}	access to information (searching)	0.99141		C_{13}	keep in touch with friends		-1.00235
C_9	spend your free time	0.95223		C_5	communicate with community, group, etc.		-0.95989
C_6	follow the agenda	0.90489		C_8	access to contact information		-0.87291
C_7	have information about events or persons	0.75042		C_{14}	make new friends and to communicate with them		-0.81348
C_{12}	use for personal presentation or information purposes	0.57986	-0.45441				
C_1	look or upload photos	0.55522	-0.51516				

3.4.2 Analytic Network Analysis (ANP)

In the 1970s, Thomas L. Saaty introduced AHP as a method for addressing decision-making problems that can be represented by a hierarchical structure consisting of goals, criteria, sub-criteria, and alternatives (Saaty, 1990). AHP method involves pairwise comparisons and ranking of alternatives to assess the relative importance of items at each level of the hierarchy (Sipahi and Timor, 2010). ANP, also developed by Thomas L. Saaty, is an extension of AHP that allows for more complex relationships and feedback among the elements in the hierarchy, including criteria, sub-criteria, and alternatives (Saaty, 2001). ANP is particularly useful when the decision problem cannot be easily defined in a strict hierarchical structure. Over the past two decades, ANP has been widely utilized in various decision-making problems. Its implementation steps can be summarized as follows:

Step 1 - Define the problem and construct the network model: In this step, the elements of the decision problem are identified, and their relationships are determined. The network model is built by considering the clusters of elements, their influence, and interdependence relationships, as well as the alternatives. The interdependencies can be of two types: "external" links between different clusters and "internal" links within the same cluster. It is important to consider all potential dependencies between the elements in order to obtain the most accurate results from the model.

In our study, we have determined two factors (Cluster 1-2 or main criteria) using FA, which serve as the sub-criteria. The loading of the two criteria on both factors is very close, indicating that our clusters are interdependent. This suggests that our problem is suitable for ANP, as the relationships between C_1 and C_{12} with Cluster 1 and Cluster 2 are present. Constructing the network structure based on FA allows for a more objective perspective and facilitates the selection of the best SMP. The network model at the cluster level is depicted in Figure 2, and all the relationships are presented in Figure 3.

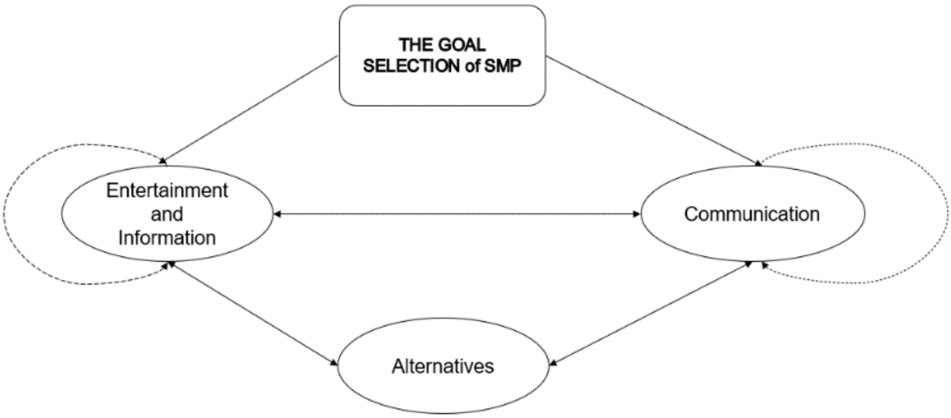

Figure 2. The Network Structure At The Cluster Level

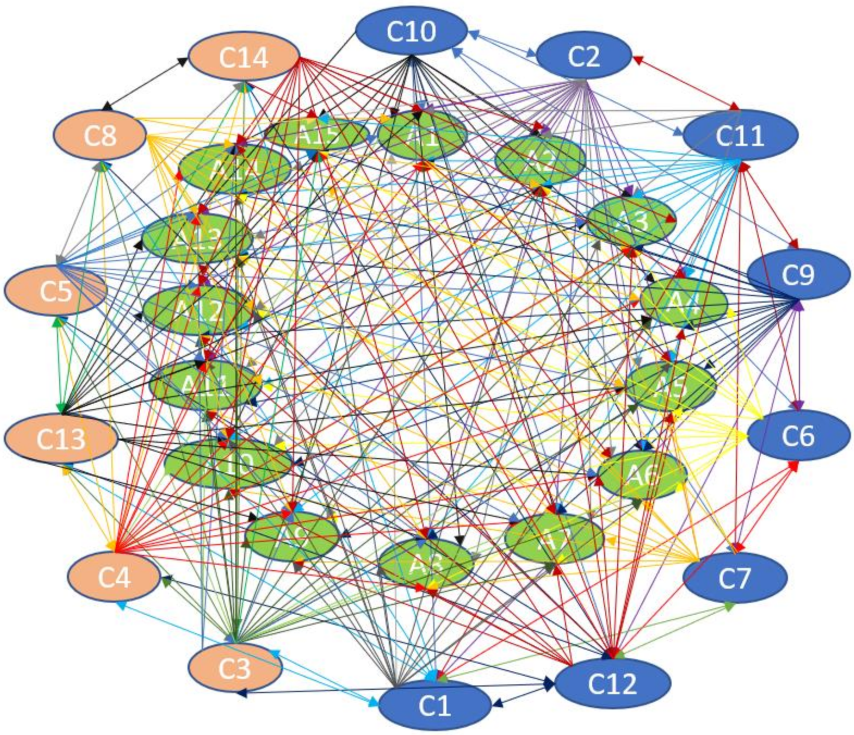

Figure 3. All Relationships In The Network Structure

Step 2 - Perform pairwise comparisons of clusters and elements and obtain priority vectors: In this step, the Decision Makers (DMs), who are typically experts, managers, or policy makers, conduct pairwise comparisons to determine the relative importance of the decision elements within each component of the network. The DMs use a ratio scale, such as the Saaty scale, ranging from 1 to 5 or 1 to 9, to make these comparisons. The pairwise comparison matrices should exhibit consistency, meaning that if option A is considered more important than option B, and option B is considered more important than option C, then option A should be considered more important than option C.

To ensure consistency, an inconsistency ratio is calculated for each pairwise comparison matrix. If the inconsistency ratio exceeds 0.1, the DMs need to review and revise the pairwise comparison matrix. In our study, we formed a group of DMs consisting of four undergraduate students selected from different classes, including 1^{st}, 2^{nd}, 3^{rd}, and 4^{th} years. The DMs conducted pairwise comparisons using a 1-9 scale, and we calculated the inconsistency ratio for each comparison. The geometric mean of the comparison matrices was then computed to obtain the final comparison matrices. Due to the need to maintain consistency and manage computational complexity, we could not ask all survey respondents to make pairwise comparisons.

Step 3 - Calculation of final priorities: The final priorities are calculated by using super matrices, which are composed of sub-matrices containing the priority weight vectors of the evaluated elements. These super matrices allow us to obtain the global priority vector of all elements, including the alternatives. Based on the information provided in Table 4, the priorities are assigned according to the criteria. For instance, Instagram (A_3) is mostly used for entertainment or relaxation (C_{10}), while Twitter (A_{12}) is primarily used to stay updated on current affairs (C_6).

The calculated weights for the criteria are presented in Table 5. According to the table, the criteria with the highest weights are C_{12} in the entertainment and information cluster (Cluster 1) and C_5 in the communication cluster (Cluster 2).

Table 4
Priority Values Based On Criteria

	Entertainment and Information								Communication					
Inconsistency	0.071	0.050	0.089	0.055	0.029	0.039	0.027	0.009	0.065	0.097	0.064	0.050	0.093	0.037
Alternatives	C_{10}	C_2	C_{11}	C_9	C_6	C_7	C_{12}	C_1	C_3	C_4	C_{13}	C_5	C_8	C_{14}
A_1-Whatsapp	0.044	0.114	0.137	0.124	0.104	0.221	0.066	0.100	0.041	0.340	0.262	0.229	0.038	0.158
A_2-MySpace	0.041	0.025	0.021	0.023	0.046	0.030	0.031	0.027	0.019	0.016	0.017	0.021	0.031	0.028
A_3- Instagram	0.198	0.173	0.070	0.168	0.108	0.136	0.085	0.244	0.229	0.142	0.184	0.076	0.113	0.158
A_4-Foursquare	0.047	0.025	0.031	0.028	0.031	0.029	0.032	0.038	0.168	0.016	0.018	0.017	0.064	0.022
A_5-WeChat	0.008	0.010	0.025	0.009	0.015	0.021	0.012	0.014	0.024	0.037	0.060	0.081	0.020	0.022
A_6-Google+	0.028	0.033	0.047	0.039	0.052	0.057	0.067	0.055	0.063	0.053	0.035	0.041	0.086	0.099
A_7-Webio	0.008	0.011	0.034	0.011	0.016	0.022	0.010	0.015	0.036	0.023	0.041	0.048	0.043	0.036
A_8-Snapchat	0.100	0.097	0.017	0.095	0.022	0.044	0.030	0.092	0.045	0.058	0.082	0.055	0.034	0.064
A_9-Facebook	0.078	0.073	0.027	0.051	0.096	0.095	0.074	0.118	0.162	0.100	0.090	0.161	0.136	0.080
A_{10}-Friendfeed	0.016	0.014	0.023	0.012	0.028	0.020	0.016	0.014	0.051	0.027	0.069	0.081	0.028	0.034
A_{11}-Tumblr	0.044	0.039	0.022	0.032	0.031	0.019	0.028	0.045	0.023	0.016	0.018	0.021	0.026	0.030
A_{12}-Twitter	0.167	0.130	0.163	0.219	0.232	0.136	0.105	0.123	0.072	0.069	0.057	0.056	0.073	0.114
A_{13}-Pinterest	0.059	0.034	0.040	0.042	0.043	0.018	0.049	0.048	0.018	0.018	0.015	0.022	0.023	0.029
A_{14}-Youtube	0.151	0.211	0.159	0.138	0.111	0.106	0.091	0.052	0.036	0.034	0.03	0.041	0.055	0.056
A_{15}-LinkedIn	0.012	0.011	0.183	0.010	0.065	0.046	0.304	0.011	0.014	0.051	0.022	0.049	0.231	0.070

Table 5
Criteria Weights

Entertainment and Information		Communication	
Criteria	Weights	Criteria	Weights
C_{10} - use to have fun or to relax	0.051	C_3 - place notification (check in)	0.089
C_2 - watch or share video	0.064	C_4 - send or receive messages	0.153
C_{11}- access to information (searching)	0.124	C_{13} - keep in touch with friends	0.168
C_9 - spend your free time	0.052	C_8 - access to contact information	0.171
C_6 - follow the agenda	0.125	C_5 - communicate with community, group etc.	0.222
C_7 - have information about events or persons	0.131	C_{14} - make new friends and to communicate with them	0.195
C_{12} - use for personal presentation or information purposes	0.245		
C_1 - look or upload photos	0.205		

Furthermore, the global priorities of the alternatives are provided in Table 6, which corresponds to the first approach, FA&ANP. The top three SMPs based on their priorities are WhatsApp, Instagram, and Twitter, while the bottom three SMPs are Myspace, WeChat, and Weibo. These rankings indicate the relative preference of the alternatives based on the identified criteria.

Table 6
Ranking According To FA&ANP

Number	Alternatives	Global Priorities	Number	Alternatives	Global Priorities
1	A_1 - WhatsApp	0.142	9	A_4 - Foursquare	0.034
2	A_3 - Instagram	0.137	10	A_{13} - Pinterest	0.034
3	A_{12} - Twitter	0.124	11	A_{10} - Friendfeed	0.029
4	A_{15} - LinkedIn	0.098	12	A_{11} - Tumblr	0.027
5	A_9 - Facebook	0.093	13	A_2 - Myspace	0.027
9	A_{14} - YouTube	0.089	14	A_5 - WeChat	0.025
7	A_6 - Google+	0.056	15	A_7 - Webio	0.024
8	A_8 - Snapchat	0.052			

3.4.3 Complex Proportional Assessment (COPRAS)

Zavadskas and Kaklauskas (1996) created the COPRAS and used for multi-criteria evaluation of both maximizing and minimizing critera values (Podvezko, 2011). The steps of COPRAS method are as follows (Zolfani and Bahrami, 2014):

Step 1 - Selecting alternatives and describing criteria: As given in Section 3.1 and Section 3.2.

Step 2 - Constructing the decision-making matrix *P*: The decision-making matrix *X* is previous given in Table 2. The matrix *P* is given below:

$$P = \begin{bmatrix} x_{11} & \cdots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{bmatrix}; \ i = \overline{1,n} \ and \ j = \overline{1,m} \tag{1}$$

where, m is the number of the alternatives, n is the number of the criteria, i represents the criteria of m, and j represents the alternatives of the n.

Step 3 - Determining criteria weights q_i: In this step, we have used two different methods, which are normalized FA, and ANP, to determine criteria weights. The mentioned weights are given in Table 7.

Table 7

Criteria Weights

FA				ANP			
Criteria	Weights	Criteria	Weights	Criteria	Weights	Criteria	Weights
C_3	0.091	C_{11}	0.073	C_{12}	0.122	C_7	0.065
C_4	0.090	C_{14}	0.070	C_8	0.111	C_6	0.062
C_{13}	0.087	C_9	0.069	C_1	0.102	C_{11}	0.062
C_5	0.083	C_6	0.066	C_{14}	0.097	C_3	0.044
C_8	0.076	C_7	0.055	C_5	0.085	C_2	0.032
C_{10}	0.075	C_{12}	0.042	C_{13}	0.084	C_9	0.026
C_2	0.075	C_1	0.040	C_4	0.076	C_{10}	0.025

Step 4 - Normalizing the decision matrix X: The normalized values of this matrix are calculated via Eq. (2).

$$\overline{x_{ij}} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}}; i = \overline{1,n} \text{ and } j = \overline{1,m} \quad (2)$$

Step 5 - Calculating the weighted normalized decision matrix $\hat{X}$: The weighted normalized values $\widehat{X_{ij}}$ are calculated via Eq. (3).

$$\widehat{x_{ij}} = \overline{x_{ij}} \,.\, \overline{q_i};\ i = \overline{1,n} \text{ and } j = \overline{1,m} \quad (3)$$

where, q_i is the significance of the ith criterion.

Step 6 - Calculating the sums P_i or R_i of criterion values: The sums P_i or R_i of criterion values, whose larger values are more preferable and whose smaller values are more preferable, Eq. (4) and Eq. (5), respectively.

$$P_i = \sum_{j=1}^{k} \widehat{x_{ij}} \quad (4)$$

$$R_i = \sum_{j=k+1}^{m} \widehat{x_j} \quad (5)$$

In Eq. (5) *(m− k)* is the number of criteria which must be minimized.

Step 7 - Determining the minimal value of R_i: The minimal value of R_i is calculated via Eq. (6).

$$R_{min} = \min_i R_i;\ i = \overline{1,n} \quad (6)$$

Step 8 - Calculating the relative significance of each alternatively Q_i: the relative significance of each alternatively Q_i is calculated via Eq. (7).

$$Q_i = P_i + \frac{R_{min} \sum_{i=1}^{n} R_i}{R_i \sum_{i=1}^{n} \frac{R_{min}}{R_i}} \quad (7)$$

Step 9 - Determining the optimally criterion: The optimally criterion is calculated via Eq. (8).

$$K = \max_i Q_i; \; i = \overline{1,n} \quad (8)$$

Step 10 - Calculating the utility degree of each alternative: The utility degree of each alternative is calculated via Eq. (9).

$$N_i = \frac{Q_i}{Q_{max}} x100 \quad (9)$$

The utility degree of each alternative is shown in Table 8, which represents FA&COPRAS, and ANP&COPRAS. According to the table, the top SMPs are WhatsApp, Instagram and Twitter, while the last SMPs are Friendfeed, WeBio and WeChat, in both approaches. However, Snapchat and Google+ have replaced to each other.

Table 8
Ranking According To FA&COPRAS, and ANP&COPRAS

FA&COPRAS		ANP&COPRAS	
Alternative	N_i	Alternative	N_i
WhatsApp	100.000	WhatsApp	100.000
Instagram	90.517	Instagram	87.566
Twitter	69.325	Twitter	68.373
YouTube	64.567	YouTube	58.173
LinkedIn	47.161	LinkedIn	48.497
Snapchat	**44.948**	**Google+**	**43.945**
Google+	**42.939**	**Snapchat**	**43.765**
Facebook	40.710	Facebook	40.849
Pinterest	37.215	Pinterest	36.941
Tumblr	34.575	Tumblr	34.381
Foursquare	34.506	Foursquare	34.261
Myspace	34.450	Myspace	34.258
Friendfeed	34.238	Friendfeed	34.056
Webio	34.219	Webio	34.023
WeChat	34.172	WeChat	33.982

3.4.4 Grey Relational Analysis (GRA)

GRA is based on the degree of similarity or difference in development trends between an alternative and the ideal alternative. If there is a stronger relationship between the alternative and the ideal alternative, the trend of change between them is consistent, otherwise the relational grade is smaller. The steps of GRA method are as follows (Hui and Bifeng, 2009):

Step 1 - Normalizing the decision matrix: There are *m* alternatives, and n criteria. X_{ij} $(i = 1,2,..., m; j = 1,2,..., n)$ denotes the value of the j^{th} index of the i^{th} alternative, $X = (x_{ij})_{mxn}$ denotes the decision matrix. Using the data pre-processing method to normalize the decision matrix, and derive the normalized decision matrix $Y = (y_{ij})_{mxn}$.

Step 2 - Determining the ideal (y_0^+) and the worst (y_0^-) alternative: The optimal value of every criterion is selected from the normalized decision matrix *Y* and composes the ideal alternative $(y_0^+ = (y_0^+(1), y_0^+(2),..., y_0^+(n))$, and the worst value of every criterion composes the worst alternative $(y_0^- = (y_0^-(1), y_0^-(2),..., y_0^-(n))$.

Step 3 - Calculating the grey relational coefficient: The grey relational coefficient of the alternative y_i in respect to the j^{th} criterion to the ideal alternative y_0^+ is given in Eq. (10).

$$\gamma_{ij}^+ = \frac{\Delta_{min}^+ + \zeta\Delta_{max}^+}{\Delta_{0i}^+(j) + \zeta\Delta_{max}^+} \tag{10}$$

where

$$\Delta_{0i}^+(j) = |y_0^+(j) - y_i(j)|,$$

$$\Delta_{min}^+ = \min_i \min_j \Delta_{0i}^+(j),$$

$$\Delta_{max}^+ = \max_i \max_j \Delta_{0i}^+(j),$$

$$i = 1,2,\dots,m \; and \; j = 1,2,\dots,n$$

The grey relational coefficient of the alternative y_i in respect to the j^{th} criterion to the worst alternative y_0^- is given in Eq. (11).

$$\gamma_{ij}^- = \frac{\Delta_{min}^- + \zeta\Delta_{max}^-}{\Delta_{0i}^-(j) + \zeta\Delta_{max}^-} \tag{11}$$

where

$\Delta_{0i}^{-}(j) = |y_0^{-}(j) - y_i(j)|,$

$\Delta_{min}^{-} = \min_i \min_j \Delta_{0i}^{-}(j),$

$\Delta_{max}^{-} = \max_i \max_j \Delta_{0i}^{-}(j),$

$i = 1,2,\dots,m \ and \ j = 1,2,\dots,n$

$\zeta \in [0,1]$, the distinguishing coefficient, usually, ζ=0.5.

Step 4 - Calculating the grey relational grade: The grey relational grade between the alternative y_i and the ideal alternative y_0^+ is given in Eq. (12).

$$R_i^{+} = \frac{1}{n}\sum_{j=1}^{n} Y_{ij}^{+} \quad (12)$$

The grey relational grade between the alternative yi and the worst alternative y0- is given Eq. (13).

$$R_i^{-} = \frac{1}{n}\sum_{j=1}^{n} Y_{ij}^{-} \quad (13)$$

Step 5 - Calculating the relative grey relational grade: The relative grey relational grade is calculated via Eq. (14).

$$C_i = \frac{R_i^{+}}{R_i^{+} + R_i^{-}} \quad (14)$$

Step 6 - Ranking the alternatives according to the values of the relative grey relational grade C_i: The grey relational grade of each alternative is shown in Table 9, which represents FA&GRA, and ANP&GRA. In the result of FA&GRA approach, the top SMPs are WhatsApp, Instagram and YouTube, while the last SMPs are WeBio, Friendfeed, and WeChat. In addition, in the result of ANP&GRA approach, the top SMPs are WhatsApp, Instagram and Twitter, while the last SMPs are Friendfeed, WeBio, and WeChat. However, YouTube and Twitter, Snapchat and Google+, Foursquare and Tumblr, Webio and Friendfeed have replaced to each other, in both approaches.

Table 9

Ranking According to FA&GRA, and ANP&GRA

Alternative	Grey Relational Grade	Alternative	Grey Relational Grade
WhatsApp	0.847	WhatsApp	0.885
Instagram	0.729	Instagram	0.724
YouTube	**0.577**	**Twitter**	**0.549**
Twitter	**0.549**	**YouTube**	**0.506**
LinkedIn	0.383	LinkedIn	0.393
Snapchat	**0.370**	**Google+**	**0.377**
Google+	**0.370**	**Snapchat**	**0.367**
Facebook	0.354	Facebook	0.357
Pinterest	0.343	Pinterest	0.344
Foursquare	**0.335**	**Tumblr**	**0.333**
Tumblr	**0.334**	**Foursquare**	**0.332**
Myspace	0.333	Myspace	0.331
Webio	**0.332**	**Friendfeed**	**0.330**
Friendfeed	**0.331**	**Webio**	**0.329**
WeChat	0.328	WeChat	0.326

4. Results and Discussion

In the previous section, we have outlined our methodology, which consists of five different approaches: FA&ANP, FA&COPRAS, ANP&COPRAS, FA&GRA, and ANP&GRA. The rankings resulting from these approaches are presented in Table 10. We have also discussed the impact of the MCDM methods and criteria weights on the rankings. Regarding the effect of criteria weights, there is no significant difference between the rankings obtained from FA&COPRAS and ANP&COPRAS. Similarly, the rankings from FA&GRA and ANP&GRA only have minor differences in the specific SMPs that occupy certain positions. For instance, YouTube and Twitter, Snapchat and Google+, Foursquare and Tumblr, Weibo and Friendfeed have replaced each other in these rankings. When considering the impact of MCDM methods on the rankings, it is observed that the rankings from ANP&COPRAS and ANP&GRA are exactly the same. Furthermore, we have found that there is no significant difference between the rankings obtained from FA&COPRAS and FA&GRA.

In the FA&ANP approach, FA is employed for clustering, while ANP is used for weighting and ranking. Since the pairwise comparison matrices of the DMs are utilized in ANP, the subjective judgments of the DMs have a greater influence on the ranking. Consequently, differences in the rankings arise. For example, Friendfeed, Foursquare, and Facebook have increased in the rankings, while YouTube and Snapchat have decreased. Additionally, we have conducted a non-parametric correlation analysis using Kendall's Tau statistic to assess the similarity between the rankings obtained from these five different approaches.

Table 10

Rankings Of 5 Different Approaches

Number	SMPs	FA&ANP	FA&COPRAS	ANP&COPRAS	FA&GRA	ANP&GRA
1	A_1 - WhatsApp	1	1	1	1	1
2	A_2 - Myspace	13	12	12	12	12
3	A_3 - Instagram	2	2	2	2	2
4	A_4 - Foursquare	9	11	11	10	11
5	A_5 - WeChat	14	15	15	15	15
6	A_6 - Google+	7	7	6	7	6
7	A_7 - Webio	15	14	14	13	14
8	A_8 - Snapchat	8	6	7	6	7
9	A_9 - Facebook	5	8	8	8	8
10	A_{10} - Friendfeed	11	13	13	14	13
11	A_{11} - Tumblr	12	10	10	11	10
12	A_{12} - Twitter	3	3	3	4	3
13	A_{13} - Pinterest	10	9	9	9	9
14	A_{14} - YouTube	6	4	4	3	4
15	A_{15} - LinkedIn	4	5	5	5	5

Table 11

Kendall's Tau Results

	FA&ANP	FA&COPRAS	FA&GRA	ANP&COPRAS	ANP&GRA
FA&ANP	1.000	0.810	0.790	0.829	0.829
FA&COPRAS	0.810	1.000	0.943	0.981	0.981
FA&GRA	0.790	0.943	1.000	0.924	0.924
ANP&COPRAS	0.829	0.981	0.924	1.000	1.000
ANP&GRA	0.829	0.981	0.924	1.000	1.000

According to Table 11, it has been determined that there is a statistically significant relationship between all the rankings at the 99% confidence level. The closest relationship is between ANP&COPRAS and ANP&GRA, with a correlation coefficient 1.000. FA&COPRAS and ANP&COPRAS – ANP&GRA, FA&COPRAS and

FA&GRA, FA&GRA and ANP&COPRAS – ANP&GRA, FA&ANP and ANP&COPRAS – ANP&GRA, FA&ANP and FA&COPRAS, and FA&ANP and FA&GRA have correlation coefficient 0.981, 0.943, 0.924, 0.829, 0.810, and 0.790, respectively. In conclusion, according to five different approaches, we can say that the best SMPs are WhatsApp, Instagram, and Twitter, respectively.

6. Conclusions

Social media refers to digital technology services that enable individuals to connect, interact, generate, and share content. In contemporary society, social media has gained immense popularity, with billions of people worldwide utilizing these platforms. It has rapidly emerged as a prominent technological phenomenon of our time, presenting numerous challenges and opportunities. Given the extensive usage of social media by large communities, organizations and institutions recognize its significance as a means to engage with and influence the public. The dynamic and rapidly evolving nature of social media necessitates careful consideration when determining which SMPs are preferred and the criteria that contribute to their selection and ranking. This decision-making process is crucial, as organizations strive to leverage SMPs effectively to achieve their objectives. The multitude of available SMPs requires decision-makers to assess user preferences, platform features, target audience demographics, and organizational goals. By evaluating these criteria and their relative importance, institutions can make informed decisions regarding their social media presence. Considering the vast number of users and the impact of SMPs, it is evident that social media platforms offer significant opportunities for institutions and organizations to connect with and influence communities. However, due to the ever-changing landscape of social media, staying informed about user preferences and effective selection criteria remains a critical challenge. In conclusion, understanding user preferences, evaluating influential criteria, and utilizing appropriate decision-making methodologies allow organizations to harness the potential of SMPs for effective community engagement. Given the transformative nature of social media, continued research and analysis in this field are vital to adapt to its evolving dynamics and leverage its potential for organizational success.

In our study, we conducted a comprehensive analysis of SMPs by identifying 14 criteria and evaluating 15 different platforms. Through the application of five different approaches, we determined the relative importance of criteria and ranked the SMPs accordingly. This enabled us to identify the criteria that hold greater significance in the selection of SMPs and determine the most preferred platforms.

WhatsApp, which is primarily known for its messaging feature, stands out in both the "Communication" and "Entertainment and Information" clusters as the most popular SMP, according to all rankings. The reason behind its success is ability to update itself by incorporating new features. For example, recently, WhatsApp has added the story feature, which is a fundamental feature of Instagram. On the other hand, some applications with millions of downloads, such as Friendfeed and Tumblr, have lost their popularity due to their failure to update their features. Additionally, certain applications are preferred or not preferred due to regional variations. For instance, although Webio and WeChat are highly popular in the Far East, they ranked lower in our study. Therefore, it is recommended that policy makers also consider cultural influences.

The findings of our study have practical implications for policy makers and organizations in the field of social media. They can use the identified important criteria to guide the development and improvement of existing SMPs, ensuring that they meet user preferences and incorporate new features. Additionally, considering the preferences and rankings of different SMPs, there is potential to create a hybrid platform that combines the most preferred criteria. Such an approach could attract a larger user base in the future.

Overall, our study contributes to the understanding of SMP selection and ranking, providing valuable insights for decision-makers in the field. As the landscape of social media continues to evolve, it is crucial to consider user preferences, and criteria importance to make informed choices and enhance user satisfaction.

Contributions of Authors

In this research, Selen AVCI AZKESKİN contributed to determining the research topic, acquiring data, analyzing and interpreting the data, and designing the study. Melike Kübra EKİZ BOZDEMİR also participated in determining the research topic, acquiring data, analyzing and interpreting the data, and designing the study. Atakan ALKAN played a role in organizing the study, examining the results, and editing and revising the manuscript.

Conflict of Interest

There is no conflict of interest to declare.

References

Ackora-Prah, J., Owusu, R., & Haabilla, K. (2018). An optimal media selection model for a company in Ghana. *Journal of Advances in Mathematics and Computer Science*, 28(6), 1-13. Doi: https://doi.org/10.9734/JAMCS/2018/43441

Bozdemir, M. K. E., & Alkan, A. (2022). Selection of social media platforms using fuzzy promethee method with different scenario types. *Journal of Engineering*

Studies and Research, 28(4), 41-50. Doi: https://doi.org/10.29081/jesr.v28i4.005

Cao, Y., Ajjan, H., & Hong, P. (2013). Using social media applications for educational outcomes in college teaching: A structural equation analysis. *British Journal of Educational Technology*, 44(4), 581-593. Doi: https://doi.org/10.1111/bjet.12066

Celli, F., Di Lascio, F.M.L., Magnani, M., Pacelli, B., Rossi, L. (2010). *Social network data and practices: the case of friendfeed.* Chai, SK., Salerno, J.J., Mabry, P.L. (Ed.) Advances in Social Computing. SBP 2010. Lecture Notes in Computer Science, (s. 346-353). Berlin: Springer. Doi: https://doi.org/10.1007/978-3-642-12079-4_43

Cetinkaya, L. (2017). The impact of WhatsApp use on success in education process. *International Review of Research in Open and Distributed Learning*, 18(7), 60-74. Doi: https://doi.org/10.19173/irrodl.v18i7.3279

Tok, G., Görentaş, I., & Avcı, S. (2021). How do Turkish students of higher education perceive Syrians: the case of Kocaeli. *International Journal of Afro-Eurasian Studies*, 6(12), 32-53. Retrieved from: https://dergipark.org.tr/en/pub/ijar/issue/64457/912651

Chang, Y., Tang, L., Inagaki, Y., & Liu, Y. (2014). What is tumblr: A statistical overview and comparison. *ACM SIGKDD explorations newsletter*, 16(1), 21-29. Doi: https://doi.org/10.1145/2674026.2674030

Chen, S., Zhang, H., Lin, M., & Lv, S. (2011). Comparision of microblogging service between Sina Weibo and Twitter. *Proceedings of 2011 International Conference on Computer Science and Network Technology*, 2259-2263, Harbin, China. Doi: https://doi.org/10.1109/ICCSNT.2011.6182424

Constantinides, E., & Stagno, M. (2012). Higher Education Marketing: A Study on the Impact of Social Media on Study Selection and University Choice. *International Journal of Technology and Educational Marketing,* 2(1), 41-58. Doi: https://doi.org/10.4018/ijtem.2012010104

Erol, I., Oztel, A., Searcy, C., & Medeni, T. (2023). Selecting the most suitable blockchain platform: A case study on the healthcare industry using a novel rough MCDM framework. *Technological Forecasting and Social Change*, 186, 122132. Doi: https://doi.org/10.1016/j.techfore.2022.122132

Gao, F., & Zhang, Y. (2013). Analysis of WeChat on iPhone. *Proceedings of 2nd International Symposium on Computer, Communication, Control, and Automation (3CA)*, 278-281, Dordrecht, Atlantis. Doi: https://doi.org/10.2991/3ca-13.2013.69

Gensler, S., Völckner, F., Liu-Thompkins, Y., & Wiertz, C. (2013). Managing brands in the social media environment. *Journal of interactive marketing*, 27(4), 242-256. Doi: https://doi.org/10.1016/j.intmar.2013.09.0

Gilbert, E., Bakhshi, S., Chang, S., & Terveen, L. (2013). "I need to try this"? a statistical overview of pinterest. *Proceedings of the SIGCHI conference on human factors in computing systems*, 2427-2436, New York, USA. Doi: https://doi.org/10.1145/2470654.2481336

Hall, C., & Zarro, M. (2012). Social curation on the website Pinterest. com. *Proceedings of the American Society for Information Science and Technology*, 49(1), 1-9. Doi: https://doi.org/10.1002/meet.14504901189

Hanum, S., Sucahyo, Y. G., & Gandhi, A. (2021). *Communication media rankings to support socialization at PPATK*. Paper presented at the meeting of the 3rd East Indonesia Conference on Computer and Information Technology (EIConCIT) Surabaya, Indonesia.Doi: https://doi.org/10.1109/EIConCIT50028.2021.9431868

Zolfani, S. H., & Bahrami, M. (2014). Investment prioritizing in high tech industries based on SWARA-COPRAS approach. *Technological and Economic Development of Economy*, 20(3), 534-553. Doi: https://doi.org/10.3846/20294913.2014.881435

Hayes, T., Ruschman, D., & Walker, M. (2009). Social Networking as an Admission Tool: A Case Study in Success. *Journal of Marketing for Higher Education*, 19, 109–124. Doi: https://doi.org/10.1080/08841240903423042

Hui, G., & Bifeng, S. (2009). Study on effectiveness evaluation of weapon systems based on grey relational analysis and TOPSIS. *Journal of Systems Engineering and Electronics*, 20(1), 106-111. Retrieved from: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6074622

Hung, Y. H., Huang, T. L., Hsieh, J. C., Tsuei, H., Cheng, C. C., & Tzeng, G. H. (2012). Online reputation management for improving marketing by using a hybrid MCDM model. *Knowledge-Based Systems*, 35, 87-93. Doi: https://doi.org/10.1016/j.knosys.2012.03.004

Javan, H. T., Khanlari, A., Motamedi, O., & Mokhtari, H. (2018). A hybrid advertising media selection model using AHP and fuzzy-based GA decision making. *Neural Computing and Applications*, 29(1), 1153-1167. Doi: https://doi.org/10.1007/s00521-016-2517-z

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, 53(1), 59-68. Doi: https://doi.org/10.1016/j.bushor.2009.09.003

Kaplan, A. M., & Haenlein, M. (2012). Social media: back to the roots and back to the future. *Journal of Systems and Information Technology*, 14(2), 101-104. Doi: https://doi.org/10.1108/13287261211232126

Kaur, S. (2016). Social media marketing. *Asian Journal of Multidimensional Research (AJMR)*, 5(4), 6-12. Retrieved from: https://www.indianjournals.com/ijor.aspx?target=ijor:ajmr&volume=5&issue=4&article=002

Li, C., & Bernoff, G. (2008). *Winning in a World Transformed by Social Technologies*. Massachusetts: Harvard Business.

Lin, C.-L., Shih, Y.-H., Tzeng, G.-H., & Yu, H.-C. (2016). A service selection model for digital music service platforms using a hybrid MCDM approach. *Applied Soft Computing, 48*, 385-403. Doi: https://doi.org/10.1016/j.asoc.2016.05.035

Lindqvist, J., Cranshaw, J., Wiese, J., Hong, J., & Zimmerman, J. (2011). I'm the mayor of my house: examining why people use foursquare-a social-driven location sharing application. *Proceedings Of The SIGCHI Conference On Human Factors İn Computing Systems*, 2409-2418. New York, USA. Doi: https://doi.org/10.1145/1978942.1979295

Luna, S., & Pennock, M. J. (2018). Social media applications and emergency management: A literature review and research agenda. *International journal of disaster risk reduction*, 27, 565-577. Doi: https://doi.org/10.1016/j.ijdrr.2018.01.006

Muruganantham, A., & Gandhi, M. (2016). Discovering and Ranking Influential Users in Social Media Networks Using Multi-Criteria Decision Making (MCDM) Methods. *Indian J Sci Technol*, 9(32), 1-11. Doi: : https://doi.org/10.17485/ijst/2016/v9i32/95171

Oralhan, B. (2019). Determining Criteria Weights That Affect Social Media Platform Selection with Fuzzy DEMATEL Approach. *IBAD Journal of Social Sciences*, Special Issue, 408-420. Doi: https://doi.org/10.21733/ibad.615528

Picazo-Vela, S., Gutiérrez-Martínez, I., & Luna-Reyes, L. F. (2012). Understanding risks, benefits, and strategic alternatives of social media applications in the public sector. *Government Information Quarterly*, 29(4), 504-511. Doi: https://doi.org/10.1016/j.giq.2012.07.002

Podvezko, V. (2011). The comparative analysis of MCDA methods SAW and COPRAS. *Engineering Economics*, 22(2), 134-146. Doi: http://dx.doi.org/10.5755/j01.ee.22.2.310

Saaty, T. L. (1990). How to make a decision: the analytic hierarchy process. *European Journal of Operational Research*, 48(1), 9-26. Doi: https://doi.org/10.1016/0377-2217(90)90057-I

Saaty, T. L. (2001). *The Analytic Network Process*. Pittsburgh, PA: RWS Publications.

Saaty, T. L. (2008). Relative measurement and its generalization in decision making why pairwise comparisons are central in mathematics for the measurement of intangible factors the analytic hierarchy/network process. *RACSAM-Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales. Serie A. Matematicas*, 102, 251-318. Doi: https://doi.org/10.1007/BF03191825.

Salleh, S., Ismail, S. H., & Abdullah, H. (2021). Optimization Model of Media Selection through Integer Programming. *International Journal of Applied Business and Information Systems*, 4(2), 142-146. Doi: https://doi.org/10.31763/ijabis.v4i2.447

Saravanakumar, M., & SuganthaLakshmi, T. (2012). Social media marketing. *Life Science Journal*, 9(4), 4444-4451. Retrieved from: http://www.lifesciencesite.com/lsj/life0904/670_13061life0904_4444_4451.pdf

Shabbir, M. S., Ghazi, M. S., & Mehmood, A. R. (2016). Impact of social media applications on small business entrepreneurs. *Arabian Journal of Business and Management Review*, 6(3), 203-205. Doi: https://doi.org/10.4172/2223-5833.1000203

Sharma, M., & Joshi, S. (2019). Optimal Media Mix for IEC Campaigns Using Fuzzy Linguistic Genetic Algorithm: A Study of Swachh Bharat Abhiyan (Clean India Mission). *Journal of Operations and Strategic Planning*, 2(1), 1-21. Doi: https://doi.org/10.1177/2516600X19857357

Sipahi, S., & Timor, M. (2010). The analytic hierarchy process and analytic network process: an overview of applications. *Management Decision*, 48(5), 705-808. Doi: https://doi.org/10.1108/00251741011043920

Sudipa, I. G., Astria, C., Irnanda, K. F., Windarto, A. P., Daulay, N. K., Suharso, W., & Wijaya, H. O. (2020). *Application of MCDM using PROMETHEE II Technique in the Case of Social Media Selection for Online Businesses*. Paper presented of the meeting of the IOP Conference Series: Materials Science and Engineering. Semarang, Indonesia. Doi: https://doi.org/10.1088/1757-899X/835/1/012059

Thelwall, M. (2009). MySpace comments. *Online Information Review*. 33(1), 58-76. Doi: https://doi.org/10.1108/14684520910944391

Wu, L.-C., Chang , K.-L., Chuang, T.-L., Chen, Y.-S., & Tsai, J.-F. (2022). Identification of Applicable YouTubers for Hotels: A Case Study of Integrated Hybrid MCDM Model. *Sustainability, 14*(18), 11494. Doi: https://doi.org/10.3390/su141811494

Wu, L. C., Chang, K. L., & Liao, S. K. (2020). A hybrid MCDM model to select optimal hosts of variety shows in the social media era. *Symmetry*, 12(1), 125. Doi: https://doi.org/10.3390/sym12010125

Zavadskas, E. K., & Kaklauskas, A. (1996). *Multicriteria Evaluation of Building (Pastatų sistemotechninis įvertinimas).* Vilnius: Technika.