

Cracking the code: Simplifying blockchain selection for DApp deployment

Descifrando el código: Simplificando la Selección de Blockchain en el Despliegue de DApps

Emiliano Acquila-Natale¹, Ángel Hernández-García², Pablo Jarabo-Valdivieso³, Julián Chaparro-Peláez⁴

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Abstract

“This study proposes a simplified method to select the most appropriate blockchain platform for deploying decentralized applications (DApps), using a multi-criteria decision analysis approach that considers both technical and business-related criteria. To explore its effectiveness, the study includes two practical scenarios where developers with different profiles assessed the relevance of various selection criteria based on the specific needs of their DApps. The study compares the results of this method with those achieved using traditional approaches such as SAW, SMARTER, and AHP, in both hierarchical and non-hierarchical forms. The findings suggest that the proposed approach offers reliable guidance while reducing the complexity of the decision-making process. Across both scenarios, security and platform maturity consistently ranked as the most important decision criteria. Other aspects, such as transaction speed, interoperability, and market penetration, also proved relevant depending on the application context. In contrast, attributes like energy consumption and data volume played a smaller role in the decision-making process.”

Keywords: Blockchain, decentralized applications, dapps, mcda, technology selection.

Resumen

Este estudio propone un método simplificado para seleccionar la plataforma blockchain más adecuada para desplegar aplicaciones descentralizadas (DApps), mediante un enfoque de análisis multicriterio que considera tanto criterios técnicos como de negocio. Para evaluar su efectividad, el estudio incluye dos escenarios prácticos en los que desarrolladores con distintos perfiles valoraron la relevancia de diversos criterios de selección según las necesidades específicas de sus DApps. El estudio compara los resultados al aplicar el método propuesto con los obtenidos al usar enfoques tradicionales como SAW, SMARTER y AHP, tanto en sus versiones jerárquicas como no jerárquicas. Los resultados sugieren que el enfoque propuesto permite tomar decisiones de forma fiable, al tiempo que reduce la complejidad del proceso. En ambos escenarios, la seguridad y la madurez de la plataforma se posicionaron de forma consistente como los criterios de decisión más importantes. Otros aspectos, como la velocidad de transacción, la interoperabilidad y la penetración de mercado también resultaron relevantes, según el contexto de aplicación. En cambio, atributos como el consumo energético y el volumen de datos desempeñaron un papel menor en el proceso de toma de decisiones.

Palabras clave: Blockchain, aplicaciones descentralizadas, dapps, análisis multicriterio, selección de tecnología.

¹ Departamento de Ingeniería de Organización, Administración de Empresas y Estadística, Universidad Politécnica de Madrid. Email: emiliano.acquila@upm.es ORCID: 0000-0003-2164-8386

² Departamento de Ingeniería de Organización, Administración de Empresas y Estadística, Universidad Politécnica de Madrid. Email: angel.hernandez@upm.es ORCID: 0000-0002-6549-9549

³ Departamento de Ingeniería de Organización, Administración de Empresas y Estadística, Universidad Politécnica de Madrid. Email: p.jarabo@alumnos.upm.es

⁴ Departamento de Ingeniería de Organización, Administración de Empresas y Estadística, Universidad Politécnica de Madrid. Email: julian.chaparro@upm.es ORCID: 0000-0002-0920-4005

1. Introduction

A decentralized application (DApp) is a software application that operates on a decentralized network, such as a blockchain. DApps can overcome the limitations of traditional applications built on centralized servers, which are vulnerable to security and trust issues (Buterin, 2014). DApps are designed to follow a set of protocols and algorithms that govern their operation, and they are an integral part of the Web3 ecosystem. The decentralized structure is facilitated by blockchain technology, which provides the infrastructure for secure and transparent transactions and data storage (Casey & Vigna, 2018; Swanson, 2015). However, DApps face various challenges, such as scalability and accessibility. As the number of users and transactions increases, DApps can become slow, and their performance may degrade, making them less suitable for high-volume applications (Zheng et al., 2018). Additionally, the use of DApps often requires a deep understanding of blockchain technology and cryptocurrency, which may hinder their adoption and expansion. Nevertheless, the potential benefits of DApps, such as increased security, transparency, and flexibility, position them as promising solutions for a wide range of applications and industries (Sompolinsky & Zohar, 2015).

Although defining the success of a DApp is complicated (Lundberg & Petró, 2022), it can largely be determined in financial and technical terms, measured by the number of users and transactions (Arvanitou et al., 2024). Success can be driven by many different factors; because DApps within a DApp ecosystem comprise a user interface and one or more smart contracts that interact with a blockchain (Leiponen et al., 2022), one of the most critical decisions in developing a DApp is the blockchain on which it will be deployed. This is evidenced, for example, in the differences in active users between the Ethereum mainnet and the xDai sidechain in the case of decentralized autonomous organizations (Faqr-Rhazoui et al., 2021).

Broadly speaking, the selection of a blockchain for deploying a DApp can be considered a multi-criteria decision analysis (MCDA) problem, where the various decision criteria—technical and business factors, in this case—must be evaluated and balanced before choosing the preferred option (Greco et al., 2016). MCDA has been widely used in business and engineering contexts for optimizing decisions involving multiple conflicting objectives (Ballesterio & Cohen, 1998; Renzi & Leali, 2017). There is a wide array of available MCDA methods, from classic models like those based on the Multi-Attribute Utility Theory (MAUT) techniques (Keeney & Raiffa, 1993), such as SMART and its variants (Edwards, 1977; Edwards & Barron, 1994) or those based on pairwise comparisons, such as Analytic Hierarchy Process (AHP) (Saaty, 1980; Saaty & Vargas, 2012), to out-ranking methods, like the family of ELECTRE (Benayoun

et al., 1966) or PROMETHEE (Brans, 1982; Brans et al., 1986) methods, or more modern techniques, such as fuzzy sets-based methods.

While some of these methods have been successfully used in the selection of blockchains for different purposes—e.g., secure data transmission in Industry 4.0 solutions for manufacturing companies (Torbacki, 2020), software development projects (Masood & Faridi, 2023), or multi-purpose frameworks (Kubler et al., 2023)—, they often involve complicated evaluations and require decision-makers to provide complex preference structures, which may lead to “analysis paralysis” or unnecessary complications; furthermore, so far there is no literature on the specific case of DApps.

Therefore, a simpler and more intuitive method could mitigate these issues by streamlining the decision-making process, making it accessible to stakeholders with varying levels of expertise in both blockchain technology and decision analysis. Such an approach would aim at prioritizing practical applicability without sacrificing thoroughness in the assessment of the relevant selection criteria. Therefore, this research aims to develop a simple yet comprehensive method to select the most suitable blockchain for DApp development and to analyze its application in real contexts.

2. Proposed Methodology

As a first approach to the selection method, for the development of the proposed method we opted for a simple MCDA methodology. More specifically, we chose to implement an adaptation of the multi-attribute utility measurement SMART (Edwards, 1977). SMART allows for easy and quick testing, does not require judgments of preference or indifference regarding entities, and can be expanded later if necessary. The original technique consists of ten steps, which we have simplified and reduced to six:

- a) Identification of stakeholders (the DApp creators), the problem or decision—the chain on which the DApp will be deployed—and the entity to be evaluated—each individual blockchain. This step conflates steps 1–3 in Edwards (1977).
- b) Identification of the different value dimensions or selection criteria. As mentioned in the introduction, the success of a DApp can be measured both in technical and financial terms. Therefore, when selecting the most suitable blockchain to develop and deploy the DApp, it seems logical to consider various technical and financial or business-related criteria. These criteria, derived from literature on blockchain and DApps, are detailed below.
 - *Technical Criteria.* When evaluating a blockchain, several technical criteria should be considered, including the consensus mechanism used to validate transactions, transaction speed, throughput or transaction

volume, energy requirements, and the level of security provided by the chain. Consensus mechanisms, such as proof of work or proof of stake, ensure the chain's security, integrity, and performance (Nguyen et al., 2019). Transaction speed, influenced by factors such as consensus mechanisms and blockchain size, must be balanced with security and decentralization (Kılıç et al., 2022). Transaction throughput, which represents the volume of data stored on the blockchain, affects scalability and performance, with solutions such as sharding and off-chain scaling to mitigate the effects of data volume (Hafid et al., 2020, 2023). In addition, the notably high energy consumption in proof-of-work blockchains like Bitcoin raises environmental and sustainability concerns (Zha et al., 2022). Finally, security against both internal and external threats is crucial for blockchain systems, with each blockchain offering distinct solutions (Zhang et al., 2019).

- **Business Criteria.** Blockchains are not only a technical innovation but also a business innovation. This technology has the potential to revolutionize traditional business processes, creating new business models, reducing costs, improving efficiency, and increasing transparency and trust. When developing and launching a DApp, it is essential to understand the costs associated with the chosen blockchain; these costs include transaction and storage costs; transaction costs imply fees for each transaction (Donmez & Karaivanov, 2022), while storage costs refer to the data stored on the blockchain, which may increase over time (Baird et al., 2019). Different types of transactions are handled on blockchains depending on the purposes of DApps, such as payments (T. Liu & Lin, 2021), asset tokenization (Sazandrishvili, 2020), or data management (Z. Liu, 2022), among others, and therefore it is important to ensure that there is a fit between the type of DApp and the blockchain's capabilities. Metrics such as Unique Active Wallets (UAW) and Total Value Locked (TVL) are essential for assessing a blockchain's popularity and market penetration, influencing investment decisions; UAW indicates user activity (Ante, 2022), while TVL reflects the DApp's usage and revenue potential (Stepanova & Eriņš, 2021). Decentralization and governance play critical roles in blockchains, affecting security, reliability, and support for DApps (Chen et al., 2021; Laatikainen et al., 2021). Scalability is necessary to accommodate more users and transactions, facilitating the real-world adoption of DApps (Prewett et al., 2020; Sandner & Schulden, 2019). Interoperability enables seamless communication between blockchains, enhancing adoption by allowing secure exchange of data and assets (Abdullah

et al., 2022; Pang, 2020; Yang et al., 2022). Finally, maturity indicates a blockchain's advancement in technology, adoption, and real-world use (Kwofie & Tetteh, 2020).

- c) While the original technique suggests that the following actions (steps 5 and 6) involve ranking the selection criteria in order of importance and rating them for relevance, given the large number of criteria and to reduce complexity, we propose a simpler weighting scheme in which the following weights will be assigned to each criterion based on the stakeholder's subjective assessment: most important criterion, weight = 2; secondary but relevant criteria, weight = 1.5; less relevant criteria, weight = 0.75; irrelevant criteria, weight = 0.
- d) Measurement of each dimension across all alternatives—i.e., all blockchains under analysis. This step requires that objective measurement levels have been defined for each dimension. Examples of blockchains to consider should include the largest by UAW, such as BNB Chain, WAX, Solana, Hive, Polygon, or Ethereum, among others (Gherghelas, 2022). For simplicity, we assume single-dimensional linear value curves.
- e) Calculation of the utility for each entity or alternative—i.e., each blockchain. The calculation is performed according to equation [1], where U_i is the value or utility of the i th entity—blockchain—, ω_i are the weights from step 3, v_i are the quantified values of each attribute or dimension (criterion) for the blockchain under analysis, and TB is a variable that represents the compatibility between the DApp's purpose and the type of transactions it performs, with a value of 5 if the blockchain is commonly used for that type of transaction, and 0 if it is not.
- f) Decision making. The decision rule is to choose the blockchain with the highest utility (U_i).

$$U_i = TB + \sum_{i=1}^N \omega_i * v_i \quad [1]$$

3. Method

3.1. Description

To evaluate the reliability and effectiveness of the proposed method for selecting a blockchain platform for DApp deployment, we designed two empirical experiments, each focused on different types of DApps. The two scenarios for each experiment analyze the suitability of various blockchain platforms for deploying specific types of DApps, applying the weighting criteria established in Section 2. The outcomes of these scenarios will be compared with the results obtained from other simple MCDA techniques, including Simple Additive Weighting (SAW) (Hwang & Yoon, 1981; MacCrimmon, 1968), SMARTER (Edwards &

Barron, 1994), and AHP (Saaty, 1980), in both hierarchical and non-hierarchical forms.

The evaluation is based on responses collected through a questionnaire completed by a different DApp developer for each scenario; the developers have varied experience and responsibility in DApp projects. These developers were selected using a purposeful and convenient sampling procedure, targeting respondents that were contacts of the research team, with current or past experience in DApp development as verified through their LinkedIn profiles. The intention behind this sampling method was to ensure the authenticity and relevance of the responses provided.

3.2. Structure of the questionnaire

The questionnaire used for this evaluation consisted of six parts:

- i. Introduction: This section provided an explanation of the study's purpose and asked for informed consent from participants.
- ii. DApp type: Respondents were asked to specify the type of DApp they were considering, choosing one out of five options: (a) Direct Transactional DApps (e.g., cryptocurrency wallets, P2P marketplaces); (b) Single Smart Contract DApps (e.g., games, lotteries, token sales); (c) Multi-Smart Contract DApps (e.g., decentralized exchanges, lending platforms, prediction markets); (d) Decentralized Autonomous Organizations; and (e) Others.
- iii. Blockchain: Participants indicated which blockchain they would initially select to deploy their DApp. They could choose from the following options: BNB Chain, Ethereum, HIVE, Polygon, Solana, WAX, or Other.
- iv. Reasons for selection: Multiple reasons for selecting the blockchain were allowed, including: (a) previous experience or familiarity with the platform, (b) speed of implementation, (c) ease of implementation, (d) community and support, and (e) other reasons.
- v. Evaluation of deployment criteria (from Section 2.b): This section focused on assessing the relevance of various criteria using sliders ranging from 0 (not important at all) to 100 (extremely important). It was divided into three subsections: (a) the importance of business vs. technical criteria; (b) the importance of specific technical factors such as transaction speed, data volume, energy consumption, and security; and (c) the importance of specific business factors, such as associated costs, market penetration, degree of decentralization, scalability, interoperability and maturity.
- vi. Feedback and comments: An open-ended section for any additional feedback or comments by the respondent.

3.3. MCDA techniques

In the fifth section of the questionnaire, the criteria weighting system was designed to allow the application of alternative simple MCDA techniques and enable comparisons with the results from the proposed method. As mentioned earlier, these techniques included:

- SAW: This method calculates the global value of each alternative as the sum of the products of criterion weights and attribute data. Two variants of SAW were applied: one using a hierarchical model where the top level consisted of business and technical criteria, with sub-levels for the specific criteria in each category; and a non-hierarchical model, where all criteria were considered at the same level.
- SMARTER: A variation of SMART, this technique was applied with the same two variants as SAW.
- AHP: The analytic hierarchy process was used to rank alternatives by comparing the importance of criteria in pairs, following the methodology outlined by Saaty (2008). In this case, a transformation function was applied to each pair of criteria, assigning values from -9 to 9 based on their ratio.

Because the original scale used was linear (from 0 to 100), to apply our proposed method we assigned the weights for each criterion as follows: the top-ranked criterion (highest value) was given a weight of 2 (most important criterion); criteria with values equal to or greater than 75 but not the highest were assigned a weight of 1.5 (secondary relevant criteria); criteria with values lower than 75 but equal to or greater than 25 were assigned a weight of 0.75 (less relevant criteria); and values below 25 were assigned a weight of 0 (irrelevant criteria).

After weighting, we calculated the utility functions associated with each alternative—each blockchain—based on values for each selection criteria ranging from 0 to 4, which are detailed in Table A.1 in Annex A. The utility values were then used to compare the most suitable blockchain for deploying the DApps in both scenarios.

3.4. Scenarios

In Scenario 1, the respondent was a Web3 game developer with three years of experience in decentralized finance (DeFi) and Web3 development. Given this background, the DApp selected for this scenario was categorized as a Single Smart Contract DApp. In Scenario 2, the respondent was a DeFi researcher with product management responsibilities and nearly ten years of experience in DeFi and blockchain development. For this scenario, the DApp chosen was categorized as a Multi Smart Contract DApp.

Table 1. Criteria Weights for Experiment 1 and Experiment 2.

Attribute (criterion)	Abbrev.	Type	Scenario 1	Scenario 2
Top-Level Criteria				
Business Criteria	ECO	Business	75	90
Technical Criteria	TEC	Technical	90	35
Second-Level Criteria				
Transaction Speed	TS	Technical	95	50
Data Volume	DV	Technical	25	20
Energy Consumption	EC	Technical	0	0
Security	SC	Technical	75	100
Associated Costs	AC	Business	40	29
Market Penetration	MP	Business	85	91
Decentralization Degree	DD	Business	25	70
Scalability	SL	Business	85	58
Interoperability	IO	Business	49	89
Maturity	MT	Business	100	89

4. Data analysis

4.1. Results and initial attribute weighting

In the first scenario, the blockchain selected by the respondent for deploying the DApp was Polygon, and the primary reasons given for this choice were previous experience, ease of implementation, and community and support. No further comments or feedback were provided by the respondent. In the second scenario, the blockchain platform selected by the respondent was Ethereum, and the reason provided for this choice was the liquidity of this blockchain; in the feedback section, the respondent suggested that uptime should be included as a relevant technical metric. They noted that certain platforms, such as Solana and Arbitrum, had experienced interruptions in block production multiple times, an issue that typically arises during periods of high volatility, which is when there is the greatest demand for transactions.

Table 1 summarizes the values assigned by each respondent to the different selection criteria. In Table 1, top-level criteria are divided into ‘Business Criteria’ and ‘Technical Criteria’, reflecting the overarching categories for evaluating blockchain platforms, second-level criteria include specific

attributes, further divided between technical and business sub-criteria, and the values for each scenario represent the relevance assigned to each criterion by the respective respondent, in the 0-100 scale.

The differences between both respondents might reflect either the varying backgrounds and experiences that shape their decision-making processes in selecting blockchain platforms for DApp deployment, or of the relevance of the type of DApp in the relative importance of the blockchain attributes. In Scenario 1, the results highlight the emphasis placed on technical criteria—particularly, transaction speed (95) and security (75)—, which might indicate the need to provide a seamless gaming experience; regarding business criteria, the need to achieve a large user base is evidenced by the importance given to maturity, market penetration—active users—and scalability of the blockchain. In Scenario 2, the responses suggest a broader understanding of the blockchain ecosystem to build infrastructures that support decentralized finance; in this sense, a higher importance is given to business criteria compared to technical criteria; the responses also highlight the absolute need for security and blockchain interoperability for the success of this type of DApp, which also explains the respondent’s preferred choice of Ethereum.

4.2. Calculation of weighting schemes

We then calculated the weights for each selection criterion across different multi-criteria decision analysis (MCDA) techniques—SAW, SMARTER and AHP—both in their hierarchical (H) and non-hierarchical forms. The hierarchical forms of SAW, SMARTER, and AHP treat economic and technical criteria separately, while their non-hierarchical forms consider them at the same level. Additionally, the results from our proposed method were included for comparison. Table 2 shows the calculated weights for each technique; in each case, the criteria were weighted according to the relative importance assigned by the respondents (as seen in Sections 3.2 and 4.1). Note that the proposed method uses a simpler scheme to assign weights, and it is not limited to the 0-1 range.

The results reveal significant variation across the techniques in how the weights were distributed. For instance, SAW-H assigned high importance to transaction speed and security, with weights of 0.27 and 0.21, respectively. This reflects a prioritization of performance-related technical factors in the hierarchical structure. In contrast, SAW in its non-hierarchical form slightly lowers the weight on technical criteria, giving maturity the highest weight, at 0.17. This indicates that when technical and economic criteria are considered together without a hierarchical distinction, longevity and stability of the blockchain are valued more. While the results of SMARTER-H and SMARTER are

Table 2. Attribute weights (Scenario 1). In bold, top ranked attribute.

Technique	TS	DV	EC	SC	AC	MP	DD	SL	IO	MT
SAW-H	0.27	0.07	0.00	0.21	0.05	0.10	0.03	0.10	0.06	0.12
SAW	0.16	0.04	0.00	0.13	0.07	0.15	0.04	0.15	0.08	0.17
SMARTER-H	0.39	0.11	0.05	0.20	0.02	0.05	0.01	0.05	0.03	0.10
SMARTER	0.19	0.03	0.01	0.08	0.05	0.13	0.03	0.13	0.06	0.29
AHP-H	0.25	0.07	0.02	0.16	0.04	0.13	0.02	0.13	0.04	0.14
AHP	0.17	0.04	0.01	0.13	0.06	0.16	0.04	0.16	0.07	0.18
Avg.	0.24	0.06	0.01	0.15	0.05	0.12	0.03	0.12	0.06	0.17
Std. Dev.	0.08	0.03	0.02	0.04	0.02	0.04	0.01	0.04	0.02	0.06
Proposed method	1.5	0.75	0	1.5	0.75	1.5	0.75	1.5	0.75	2

Table 3. Attribute ranking across the different MCDA techniques (Respondent 1).

Technique	TS	DV	EC	SC	AC	MP	DD	SL	IO	MT
SAW-H	1	6	10	2	8	4	9	4	7	3
SAW	2	8	10	5	7	3	8	3	6	1
SMARTER-H	1	3	7	2	9	5	10	5	8	4
SMARTER	2	8	10	5	7	3	8	3	6	1
AHP-H	1	6	10	2	8	4	9	4	7	3
AHP	2	8	10	5	7	3	8	3	6	1
Avg.	1	6	10	3	8	4	9	4	7	2
Proposed method	2	6	10	2	6	2	6	2	6	1

different in their hierarchical and non-hierarchical forms, both emphasize transaction speed and security, albeit with varying intensities; however, the non-hierarchical version—same as in SAW—also emphasizes the importance of maturity when all attributes are considered together. In addition, SMARTER-H places a significantly higher weight on transaction speed (0.39) than SMARTER (0.19), suggesting a more robust prioritization of speed when technical criteria are analyzed hierarchically. AHP-H and AHP follow similar patterns but allocate slightly higher weights to market penetration and scalability.

Our proposed method applies a simpler, more intuitive weighting scheme, where the top-ranked criterion was maturity and the next high-ranked criteria—transaction speed, security, scalability, and market penetration—were each assigned a weight of 1.5. This resulted in a clear differentiation between the most important criteria and those considered less relevant, such as data volume and energy consumption, which had already received very low or near-zero weights in most techniques.

The average weights across all methods provide an overall perspective on the importance of each criterion. Transaction speed and security consistently ranked high, while energy consumption received the lowest weights across

all techniques—except for the hierarchical version of SMARTER. The standard deviation values further highlight how the various techniques diverged in their treatment of criteria, such as transaction speed, security and maturity.

For Respondent 1, the rankings (Table 3) reflect a heavy focus on technical performance. Transaction speed and security consistently received high rankings across all techniques, with both attributes ranked in the top two positions for SAW, SMARTER, and AHP. This is consistent with the respondent's background as a Web3 game developer, where real-time performance and system security are paramount. Maturity and market penetration were also considered important, particularly when considering all the attributes at the same level. These rankings indicate that the respondent values immediate technical capabilities and current adoption of the blockchain over other aspects related to the long-term viability of the platform.

Respondent 2 placed a less balanced relevance of technical and economic criteria, giving more importance to economic criteria in the decision. Consequently, the results are more consistent across techniques, except for SMARTER-H and, to a lesser extent AHP-H. The weighting schemes (Table 4) reveal a high importance of security-related aspects—most notably when using SMARTER—that reflect the criticality

Table 4. Attribute weights (Scenario 2). In bold, top ranked attribute.

Technique	TS	DV	EC	SC	AC	MP	DD	SL	IO	MT
SAW-H	0.08	0.03	0.00	0.16	0.05	0.15	0.12	0.10	0.15	0.15
SAW	0.08	0.03	0.00	0.17	0.05	0.15	0.12	0.10	0.15	0.15
SMARTER-H	0.07	0.04	0.02	0.13	0.02	0.10	0.03	0.02	0.05	0.05
SMARTER	0.05	0.02	0.01	0.29	0.03	0.19	0.08	0.06	0.13	0.13
AHP-H	0.05	0.03	0.01	0.12	0.03	0.19	0.10	0.10	0.19	0.19
AHP	0.07	0.03	0.01	0.18	0.04	0.16	0.10	0.09	0.16	0.16
Avg.	0.07	0.03	0.01	0.17	0.04	0.16	0.09	0.08	0.14	0.14
Std. Dev.	0.01	0.00	0.01	0.06	0.01	0.03	0.03	0.03	0.04	0.04
Proposed method	0.75	0	0	2	0.75	1.5	0.75	0.75	1.5	1.5

Table 5. Attribute ranking across the different MCDA techniques (Respondent 2).

Technique	TS	DV	EC	SC	AC	MP	DD	SL	IO	MT
SAW-H	7	9	10	1	8	2	5	6	3	3
SAW	7	9	10	1	8	2	5	6	3	3
SMARTER-H	3	6	9	1	8	2	7	10	4	4
SMARTER	7	9	10	1	8	2	5	6	3	3
AHP-H	7	9	10	4	8	1	5	5	1	1
AHP	7	9	10	1	8	2	5	6	2	2
Avg.	7	9	10	1	8	2	5	6	3	3
Proposed method	5	9	9	1	5	2	5	5	2	2

of the security of DeFi applications; because security is generally associated with more mature blockchains, it does not come as a surprise that maturity also gets consistent high weights. The other two most important attributes to consider in the decision are market penetration and interoperability, suggesting a strong preference for well-established platforms, while acknowledging the need for wider reach through the use of different blockchains.

As mentioned earlier, the differences across techniques were narrower, even though the results exhibit some variability between the hierarchical forms of SMARTER and AHP and the rest of methods. Interestingly, when the differences in relevance across top-level criteria are significant, as in this case, the results of SAW and SAW-H show high consistency, something that did not happen in Scenario 1.

The average weights across all techniques provide an overall perspective on the importance of each criterion. Security and market penetration ranked high consistently, whereas energy consumption and data volume received the lowest weights across the techniques, indicating that these factors are less relevant to the respondent's decision-making process.

Regarding ranked attributes (Table 5), Respondent 2 placed greater importance on attributes associated with platform stability and market adoption. Security,

market penetration, maturity and interoperability consistently ranked high across all techniques. In this case, transaction speed was given much lower relevance than in Scenario 1, highlighting the differences between both types of DApps, with Web3 games requiring high transaction speeds, which are essential for asset trading and smooth user experience (Kapoor, 2024), and DeFi applications having security at their center (Parisi & Budorin, 2024).

4.3. Utility calculations

The attribute values for each blockchain were derived from the value functions for the selection criteria provided in Table A.1 (Annex A), after collecting the information about the six blockchains under analysis during August 2023. The value functions in Table A.1 assign a score between 0 and 4 based on the performance of each blockchain on specific technical and economic criteria. For example, transaction speed receives the highest value (4) for blockchains with more than 100,000 transactions per second (TPS), while blockchains with fewer than 5,000 TPS receive a value of 1. Similarly, market penetration is based on the number of active users (UAW), with platforms having more than 400,000 users scoring 4, and those with fewer than 100,000 scoring 1. The resulting attribute values, summarized in

Table A.2, were combined with the calculated weights to generate utility values.

For Respondent 1, who focused heavily on technical performance, Polygon and WAX consistently ranked high across all techniques (Table 6). Polygon's strong performance in transaction speed and scalability, combined with reasonable market penetration and maturity, made it a suitable choice—Polygon was also the blockchain initially chosen by Respondent 1. However, WAX, with its strong performance in security and scalability, and reasonable transaction speeds, emerged as the top contender, being the alternative with the highest utility under all criteria. This result is highly conditioned by (a) the fact that WAX, a more recent blockchain, was highly popular during the period of data collection, and had a larger overall global score (30, compared to Solana's 26 in second place), and (2) that reasons such as previous experience, ease of implementation, and community and support, were not considered in the decision. Notably, the application of SMARTER suggested that Ethereum would be the alternative with the highest value, probably owing to its high maturity and transaction speeds.

For Respondent 2 (Table 7), WAX and Ethereum received the highest utility scores across most techniques—with BNB on a close third place—probably owing to WAX's strong technical performance and Ethereum's high performance across all business criteria attributes—particularly, maturity and degree of decentralization—except for associated costs, which were not considered very relevant for this kind of DApp. Interestingly, only the method proposed in this study, which also considers the typical uses of each

blockchain—penalizing WAX, a GameFi-focused blockchain and rewarding Ethereum, a blockchain well-suited for DeFi purposes—resulted in the same decision as the initial choice of Respondent 2.

Interestingly, Solana and Hive consistently performed less favorably across both respondents. Hive's poor performance in critical areas like transaction speed, adoption or maturity led to low utility scores, while Solana's security issues and low market penetration negatively impacted its utility.

This utility analysis shows that while the specific weighting schemes applied by different techniques can influence the ranking of blockchains; as expected, platforms with high values across most attributes like WAX and Ethereum emerge consistently as strong options. The proposed method, with its straightforward approach to weighting, produces results that align well with the more complex MCDA techniques, further validating its utility for DApp deployment decision-making.

4.4. Discussion of results

The results of this study reveal several insights into the selection of a blockchain for DApp deployment, highlighting the most important and less relevant attributes, differences between DApp types, and the effectiveness of various MCDA techniques.

Regarding relevance, on the one hand, the most important attributes across both respondents were security and maturity of the blockchain. These attributes consistently received

Table 6. Utilities for each blockchain across techniques (Scenario 1).

Technique	SAW-H	SAW	SMARTER-H	SMARTER	AHP-H	AHP	This study
BNB	2.09	2.53	1.84	2.75	2.34	2.60	32.50
Ethereum	2.65	2.74	2.80	3.08	2.77	2.82	29.75
Hive	1.86	1.83	1.55	1.54	1.81	1.81	25.75
Polygon	2.31	2.46	2.33	2.64	2.43	2.51	31.25
Solana	2.30	2.34	2.46	2.36	2.38	2.36	25.75
WAX	2.96	2.92	2.85	2.71	2.95	2.92	37.50

Table 7. Utilities for each blockchain across techniques (Scenario 2).

Technique	SAW-H	SAW	SMARTER-H	SMARTER	AHP-H	AHP	This study
BNB	2.39	2.38	1.13	2.32	2.66	2.45	27.25
Ethereum	2.60	2.60	1.15	2.28	2.68	2.57	28.00
Hive	1.65	1.66	0.93	1.95	1.46	1.63	17.00
Polygon	2.23	2.23	1.03	2.00	2.31	2.21	25.75
Solana	2.16	2.16	1.01	1.85	2.13	2.10	24.25
WAX	2.84	2.85	1.55	3.03	2.75	2.84	27.50

high weights across all MCDA techniques, especially for the DeFi researcher in Scenario 2, who prioritized security and maturity due to the long-term sustainability and risk management requirements of DeFi applications; the Web3 game developer in Scenario 1 also emphasized transaction speed, reflecting the need for real-time performance and seamless user experiences in gaming environments. Market penetration and interoperability were also found to be relevant, especially for platforms targeting a larger user base and aiming to integrate across different blockchain ecosystems. On the other hand, attributes like energy consumption and data volume were consistently less relevant in the decision-making process for both respondents. Energy consumption, although important from a sustainability perspective, was not prioritized by either respondent, likely because immediate technical and business factors take precedence. Data volume was also of lesser concern, perhaps due to its indirect impact on the performance of DApps compared to more critical factors like scalability, interoperability or decentralization.

The type of DApp also influenced the relative importance of the attributes. The Web3 game developer (Scenario 1) placed more importance on technical performance, such as transaction speed and scalability, which are essential for ensuring smooth user experience and handling in-game transactions. In contrast, the DeFi researcher and product manager (Scenario 2) focused more on security and other business-related attributes, such as market penetration, maturity and interoperability, reflecting the higher risk associated with financial applications.

The method proposed in this study demonstrated its ability to simplify the decision-making process while aligning well with more complex MCDA techniques. By directly assigning weights based on the respondents' rankings of importance, the method streamlined the analysis without sacrificing the accuracy of the results. This approach produced outcomes consistent with more sophisticated methods, such as AHP and SMARTER, particularly in identifying the most suitable blockchain for each scenario. However, as blockchain ecosystems evolve, the method might benefit from periodic updates to the value functions used for utility calculation. Updated data on attributes such as transaction speed, market penetration, and security would enhance the relevance and accuracy of the decision-making process.

Additionally, some decision attributes not included in the current analysis, either from existing literature (Gräbe et al., 2020; Kubler et al., 2023; Nanayakkara et al., 2021; Polge et al., 2021) or identified in the questionnaire, such as the familiarity of developers with a particular blockchain, ease of implementation, and community support, should also be considered. Feedback from Scenario 2, where the respondent mentioned the importance of uptime as a

technical metric, further highlights the need to incorporate operational reliability metrics. These variables can play a significant role in a blockchain's selection, especially for developers and decision-makers with limited resources or experience.

5. Conclusion

This study demonstrated the utility of a simplified MCDA method for selecting a blockchain for DApp deployment. By applying both hierarchical and non-hierarchical approaches across multiple decision-making techniques, we identified the most relevant attributes for different types of DApps. For Web3 game developers, transaction speed, maturity and scalability were considered of utmost importance, while DeFi researchers prioritized security, maturity, and market penetration.

The study also revealed that some attributes, such as energy consumption and data volume, play a marginal role in the decision-making process, especially when the focus seems to be on immediate technical performance or long-term stability.

The method proposed in this study proved effective in guiding the decision-making process, simplifying the analysis while delivering results consistent with more complex techniques. However, there is a need for ongoing updates to the value functions and the inclusion of additional decision criteria, such as developer familiarity, ease of implementation, community support, and uptime, to further refine the decision-making process in an evolving blockchain ecosystem.

This research provides a foundation for future studies to explore more comprehensive frameworks for blockchain selection, incorporating a wider range of attributes and stakeholders to ensure that DApp developers can make informed, efficient, and effective decisions.

Notes

This study is a substantially revised and extended version of the work "A method to determine the best DApp-Blockchain fit", presented at the 18th International Conference on Industrial Engineering and Industrial Management - XXVIII Congreso de Ingeniería de Organización (Acquila-Natale et al., 2025).

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ANNEX A**Table A.1.** Value functions for the different selection criteria (attributes).

Criteria (Attribute)	Value	Assigned value
Transaction Speed	> 100,000 TPS	4
	50,000 – 100,000 TPS	3
	5,000 – 50,000 TPS	2
	< 5,000 TPS	1
	No data found	0
Data Volume	> 5M daily transactions	4
	1M – 5M daily transactions	3
	500,000 – 1M daily transactions	2
	< 500,000 daily transactions	1
	No data found	0
Energy Consumption	Net zero consumption	4
	Low energy consumption	3
	Medium energy consumption	2
	High energy consumption	1
	No data found	0
Security	No security breaches found	4
	1 security breach in its history	3
	Multiple security breaches in its history	2
	1 security breach within the last year	1
	No data found/several security breaches within the last year	0
Associated costs	Free transactions	4
	\$0.0001 - \$0.001 USD per transaction	3
	\$0.001 - \$0.10 USD per transaction	2
	\$0.10 – \$1.00 USD per transaction	1
	> \$1.00 USD per transaction	0
Market penetration (UAW)	> 400,000 active users	4
	200,000 – 400,000 active users	3
	100,000 – 200,000 active users	2
	0 -100,000 active users	1
	No data found	0
Degree of decentralization	> 5,000 validation nodes	4
	500 – 5,000 validations nodes	3
	50 – 500 validation nodes	2
	0 – 50 validation nodes	1
	No data found	0
Scalability	Highly scalable	4
	Scalability issues	2
	No data found / Poor scalability	0
Interoperability	Interoperable with all other chains	4
	Interoperable with some other chains	2
	No data found / Not interoperable with other chains	0

(Continued)

Table A.1. Value functions for the different selection criteria (attributes). (*continued*)

Criteria (Attribute)	Value	Assigned value
Maturity	> 2,000 DApps listed	4
	500 – 2,000 DApps listed	3
	100 – 500 DApps listed	2
	0 – 100 DApps listed	1
	No data found	0

Table A.2. Attribute values for each blockchain alternative.

Blockchain	Technical Criteria					Business criteria				
	TS	DV	EC	SC	AC	MP	DD	SL	IO	MT
BNB Chain	1	2	3	1	1	4	1	4	2	4
Ethereum	4	1	3	1	0	2	4	4	2	4
HIVE	0	3	0	4	4	1	0	4	0	1
Polygon	3	1	3	1	2	2	2	4	2	3
Solana	3	3	4	1	3	1	3	4	2	2
WAX	2	4	3	4	4	3	2	4	2	2