# SOCIAL AND ECONOMIC STUDIES OF THE CDBC READINESS

**Ilyes Karoui, University of Carthage**
**Hend Kmiha, University of Carthage**

## ABSTRACT

*This paper harnesses the power of AI-driven economic and social analysis to comprehensively evaluate a nation's Readiness for the adoption of a Central Bank Digital Currency (CBDC). Through advanced AI methodologies, we examine vital parameters encompassing economic stability, technological infrastruc- ture, regulatory environment, and societal sentiment. Our innovative approach not only identifies potential hurdles but also offers proactive strategies to mitigate risks, ensuring a smooth CBDC integration. The culmination of our study presents a practical scoring framework that quantifies readiness, enabling policy- makers to gauge their progress relative to global standards. This research contributes a pivotal toolset for effective decision-making, fostering an environment conducive to the successful implementation of CBDCs.*

**Keywords:** CBDC, Digital Currency, Machine Learning, Readiness, Socioeconomic Analysis, Scoring

## INTRODUCTION

In the current landscape, the pervasive wave of digitization is sweeping through various sectors, ushering in transformative changes. This digital revolution has now extended its reach to the realm of banking, where the concept of digital currency has taken center stage. As a result, central banks worldwide are compelled to seriously consider the implications of this digital transformation. At the forefront of this movement is the ambitious endeavor known as the Central Bank Digital Currency (CBDC) Ward & Rochemont (2019). This groundbreaking project represents a convergence of technological innovation and monetary policy, with the potential to revolutionize the way economies handle transactions, payments, and financial interactions.

This innovative project is not only emblematic of a digital age but also intricately linked with blockchain technology. The CBDC, while maintaining its status as a centralized form of currency, harnesses the secure and transparent attributes of blockchain Dashkevich et al., (2020); Golosova & Romanovs (2018) This convergence infuses the digital currency with the power of legal tender, enabling transactions to be conducted swiftly and securely, while also enhancing accountability and traceability. It is precisely this potential for improved efficiency, financial inclusion, and enhanced oversight that has captured the interest of central banks, spurring their exploration of the CBDC landscape.

As the concept of Central Bank Digital Currency gains momentum, an increasing number of countries are delving earnestly into its exploration. This burgeoning interest is reflected in the launch of pilot pro- grams and comprehensive research initiatives by various central banks worldwide. These proactive measures underscore the recognition of CBDCs as a potential transformative force in modernizing financial systems and redefining the landscape of


**Citation Information:** Karoui, I., Kmiha, H. (2024). Social and economic studies of the cdbc readiness. *Academy of Strategic Management Journal, 23*(2), 1-14.

transactions and payments. Through these pilot projects and rigorous stud- ies, nations are not only evaluating the technical feasibility and security aspects of CBDC implementation but also gauging its potential socioeconomic impact. This concerted global effort signifies a crucial phase in the evolution of monetary systems, as nations work collectively to unlock the advantages and address the complexities that CBDCs bring to the fore.

Amid the intricate web of considerations surrounding CBDCs, careful analysis of readiness and potential risks becomes paramount to ensure that the transition to this digital frontier is seamless, secure, and maximally beneficial for all stakeholders involved. In fact, undertaking significant projects inherently carries risks, and it is crucial to conduct thorough readiness studies before their implementation. These studies assess the preparedness of various aspects, such as technological infrastructure, regulatory frameworks, stakeholder engagement, and potential impacts on the economy or society. Properly evaluating these factors helps to identify potential challenges and vulnerabilities that might arise during project execution. Furthermore, readiness studies enable project managers and decision-makers to formulate effective mitigation strategies and contingency plans, reducing the likelihood of unexpected setbacks. By comprehensively assessing the project's feasibility and potential pitfalls, organizations can make informed decisions, allocate resources wisely, and navigate complexities with a higher likelihood of success.

When it comes to gauging the readiness of projects, various comprehensive models have been developed to provide structured assessments. These models offer systematic approaches to evaluate different aspects of preparedness, ensuring that all facets of a project are thoroughly examined. Among these models, several stand out, including the EFQM (European Foundation for Quality Management) framework Suárez et al., (2014), the 7S McK- insey model Channon & Caldart (2015), Fuzzy Logic methodologies Mottaghi & Akhtardanesh (2010); Auer et al., (2022), and the CEAO (Context, Environment, Actors, Operations) approach Zhang et al., (2012). Each of these models provides a distinct perspective, catering to different project requirements and contexts. The EFQM framework focuses on organizational excellence, the 7S model emphasizes inter- nal alignment, Fuzzy Logic accommodates uncertainty and imprecise information, and the CEAO approach considers broader contextual factors. By utilizing these diverse models, project managers and stakeholders can systematically analyze and enhance various dimensions of readiness, ensuring a well-rounded and in- formed approach to project execution. Additionally, some recent studies have been established to question the factors that determine the adoption of Central Bank Digital Currency, signaling a growing interest in unraveling the intricacies of its acceptance and integration into the financial ecosystem (AlSharji et al., (2018); Maryaningsih et al., (2022)).

While the array of readiness models provides valuable frameworks for evaluating various projects, the com- plexity inherent in CBDC readiness necessitates a more intricate analysis. CBDC's multifaceted nature, touching upon economic, technological, social, and political realms, makes assessing its readiness partic- ularly challenging. Thus, our interest lies in conducting a comprehensive study that delves deeper into country readiness. We propose to gauge economic preparedness through rigorous economic indicators and delve into social readiness by incorporating Hofstede's cultural dimensions Hofstede, (2011). Additionally, our examina- tion will encompass the critical factor of political stability, recognizing the influence of political dynamics on the successful deployment of CBDCs. By amalgamating these multidimensional aspects, our study aims to offer a more holistic understanding of CBDC


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readiness, enabling a more informed assessment tailored to the intricate nature of this transformative initiative.

In this paper, we embark on a comprehensive exploration by presenting an economic and social study fo- cused on assessing the CBDC readiness. Our approach goes beyond traditional assessments, as we introduce a political dimension into our model to capture the intricate interplay between policy decisions, stakeholder dynamics, and potential national and international political implications. A distinguishing feature of our study lies in the integration of artificial intelligence (AI) techniques, which include clustering and classi- fication methods. These AI-driven approaches enable us to systematically analyze and categorize various dimensions of CBDC readiness, contributing to a nuanced understanding of the intricate factors at play. Our efforts culminate in the provision of a readiness scoring mechanism by country, offering valuable insights to policymakers, stakeholders, and the broader global community. This scoring framework represents a crucial step forward in comprehensively evaluating the diverse factors that influence CBDC readiness across different nations.

## Economic and Social Readiness Assessment for CBDC Implementation

In this section, we will delve into an in-depth examination of the economic and social aspects surrounding the CBDC implementation readiness. Our analysis draws heavily from data provided by the World Bank, a reputable source in the field of economic research. It is essential to note that the feature selection process employed here is specifically tailored to enhance our understanding of the broader context of digitalization, information technology infrastructure, and the banking sector. Through this meticulous approach, we aim to gain valuable insights into the intricate interplay between CBDC adoption, economic dynamics, social implications, and the critical role of technological foundations.

**Economic readiness**: In this section, we will delve into the Economic Readiness Study, beginning with an overview of the dataset employed and the application of our chosen model. By describing these foundational elements, we establish a solid framework for comprehensively assessing a country's CBDC readiness. Through this exploration, we aim to provide valuable insights into the economic factors that shape the landscape for successful CBDC adoption.

**Database setup**: The study conducted in this sector encompassed an exhaustive examination of CBDC readiness, encompass- ing insights from central banks across the globe. It is worth noting, however, that due to the comprehensive nature of the research and the available resources, our analysis focused on a subset of countries. Specifically, the study covered 110 countries, allowing for a comprehensive evaluation of CBDC readiness in a diverse range of economic and social contexts. This approach ensures a robust and representative exploration of the subject matter, shedding light on key considerations within the global landscape of CBDC adoption.

Following a meticulous feature selection phase, driven by correlation and Principal Component Analysis (PCA) analyses, a refined set of economic indicators emerged as pivotal in the assessment of the CBDC readiness. These indicators have been strategically chosen to effectively capture the nuanced dynamics of CBDC integration within the overarching context of digitalization, information technology infrastructure, and the banking sector. The selected indicators encompass a comprehensive range of economic dimensions Table 1.

**Table 1**
**KEY INDICATORS FOR CBDC ADOPTION**


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| | |
|---|---|
| Inflation, GDP deflator (annual %) | Inflation as measured by the annual growth rate of the GDP implicit de- flator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. |
| Access to electricity (% of population) | The percentage of the population with access to electricity, typi- cally measured as the proportion of households or individuals with elec- tricity connections |
| Mobile cellular sub- scriptions (per 100 people) | The number of mobile cellular sub- scriptions per 100 people in the pop- ulation |
| Urban population (% of total population) | The percentage of the total popula- tion living in urban areas |
| Merchandise trade (% of GDP) | The value of merchandise trade (ex- ports plus imports) as a percentage of Gross Domestic Product (GDP). |
| Foreign direct invest- ment, net inflows (% of GDP) | Net inflows of foreign direct invest- ment as a percentage of GDP |
| Population ages 15-64 (% of total population) | The percentage of the total popula- tion living in urban areas tion that falls within the age group of 15 to 64 years. |
| ICT service exports (% of service exports, BoP) | Exports of Information and Com- munication Technology (ICT) ser- vices as a percentage of total service exports in the Balance of Payments (BoP). |
| Individuals using the Internet (% of popula- tion) | The percentage of the population that has access to the Internet. |
| Net primary income (BoP, current US$) | Net primary income flows as recorded in the Balance of Pay- ments (BoP) in current US dollars |
| GDP growth (annual %) | The annual percentage change in Gross Domestic Product (GDP) as a measure of economic growth. |
| GDP (current US$) | Gross Domestic Product (GDP) in current US dollars. |
| Communications, com- puter, etc. (% of service imports, BoP) | The percentage of service imports in the Balance of Payments (BoP) that is attributed to communica- tions, computer, and related ser- vices. The percentage of commercial ser- vice imports that consist of insur- ance and financial services |
| Fixed broadband sub- scriptions Insurance and financial services (% of commer- cial service imports) | The number of fixed broadband in- ternet subscriptions. |

**Results & Interpretations**: In our comprehensive approach to assessing CBDC readiness, we will embark on both backward and forward analyses. Beginning with the backward analysis, we aim to gain insights by leveraging economic indica- tors to illuminate the global landscape's preparedness for CBDC implementation. Employing a clustering methodology, we will categorize countries based on economic indicators, shedding light on varying degrees of readiness. This retrospective examination will provide a nuanced understanding of the diverse factors influencing CBDC adoption on a global scale Alfar et al., (2023).

Transiting to the forward analysis, our focus will shift towards uncovering the underlying reasons behind both successes and failures in CBDC implementation. Delving into case studies, we will investigate countries that have encountered challenges in adopting CBDCs and identify


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the contributing factors that led to their set- backs. Simultaneously, we will explore the success stories, scrutinizing the strategies, regulatory frameworks, and socioeconomic conditions that facilitated their successful CBDC implementation. By undertaking this comprehensive examination, we intend to offer valuable insights into the multifaceted landscape of CBDC adoption, enabling us to anticipate potential obstacles and opportunities that lie ahead.

**Backward analysis**: Utilizing the diverse set of economic indicators mentioned earlier, one can discern the potential for forming distinct clusters that encapsulate specific economic dimensions. These clus-ters would help in categorizing countries based on their economic characteristics, technological infrastructure, and digitalization landscape. By employing advanced clustering algorithms (more specifically k-means) one could identify patterns and relationships within the data that might not be immediately apparent Figure 1.

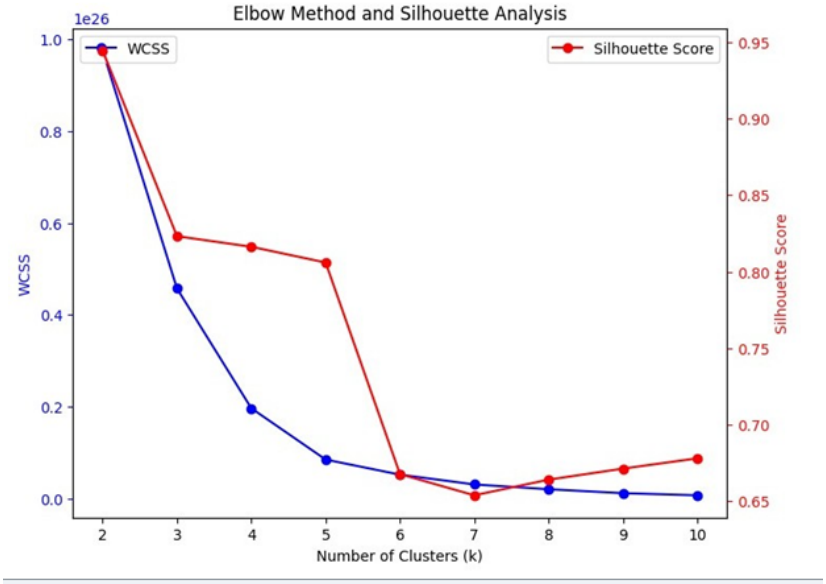


**FIGURE 1**
**ELBOW METHOD AND SILHOUETTE ANALYSIS**

The utilization of the elbow method and silhouette score in our analysis yields a distinct optimal cluster value of 6. This outcome, indicative of the K-means clustering algorithm, offers valuable insights when interpreted in the context of economic studies.

Just as the elbow method bends to pinpoint the inflection point where additional clusters provide diminishing returns in variance reduction, and the silhouette score emphasizes the separation between clusters, the ideal cluster count of 6 underscores the granularity needed to comprehensively assess various facets. Each cluster represents a unique dimension from economic stability and regulatory dynamics to technological infrastructure and societal reception.

Drawing a parallel to the precision and accuracy of a CBDCTracker, which monitors and evaluates the in- tricate journey of CBDC implementation, the optimal cluster count signifies our ability to discern nuanced patterns and trends. Like a tracker that ensures informed decision-making, this clustering result guides poli- cymakers and stakeholders towards a holistic understanding of a nation's preparedness for the transformative integration of a Central Bank Digital Currency Figure 2.


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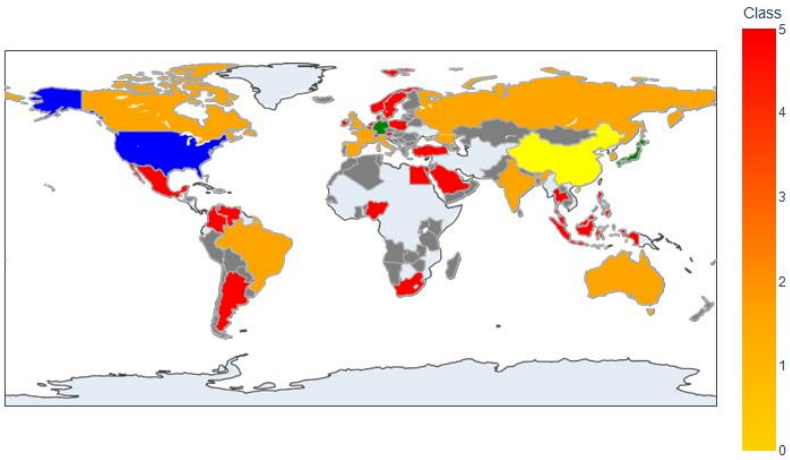


**FIGURE 2**
**ECONOMIC CLUSTERING**

The K-means cluster centers presented in the table reveal distinctive characteristics within the dataset. Each row corresponds to a distinct cluster, while each column represents a specific economic or demographic fea- ture. Notably, Cluster 2 stands out with its low inflation rate (0.87%) and universal access to electricity (100%), indicative of stable economies with widespread infrastructure. Conversely, Cluster 5 demonstrates advanced technological connectivity, boasting the highest mobile cellular subscriptions (125.56 per 100 peo- ple) and internet usage (67.90%). Cluster 1 reflects robust economic growth with a substantial GDP and growth rate (2.14%). Cluster 0, on the other hand, appears to have limited foreign direct investment (4.40% of GDP) Table 2.

**Table 2**
**K-MEANS CENTERS**

| **Cluster** | **0** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **Inflation, GDP deflator** | 6.45 | 1.89 | 0.87 | 2.98 | 3.18 | 6.29 |
| **(% )** | | | | | | |
| **Access to electricity (%** | 85.67 | 100 | 100 | 99.96 | 98.67 | 96.81 |
| **of population)** | | | | | | |
| **Mobile cellular sub-** | 107.19 | 101.04 | 125.83 | 97.96 | 114.12 | 125.56 |
| **scriptions (per 100** | | | | | | |
| **people)** | | | | | | |
| **Urban population (% of** | 59.13 | 81.79 | 84.33 | 56.03 | 75.38 | 73.88 |
| **total population)** | | | | | | |


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| | | | | | | |
|---|---|---|---|---|---|---|
| **Merchandise trade (%** | 68.21 | 21.3 | 49.04 | 38.33 | 43.31 | 86.48 |
| **of GDP)** | | | | | | |
| **Foreign direct invest-** | 4.4 | 1.71 | 1.36 | 2.32 | 2.15 | 5.48 |
| **ment, net inflows (% of** | | | | | | |
| **GDP)** | | | | | | |
| **Population ages 15-64** | 64.43 | 66.15 | 62.87 | 71.22 | 66.93 | 66.4 |
| **(% of total population)** | | | | | | |
| **ICT service exports** | 7.71 | 5.67 | 5.98 | 11.13 | 11.18 | 8.95 |
| **(% of service exports,** | | | | | | |
| **BoP)** | | | | | | |
| **Individuals using the** | 50.56 | 80.68 | 86.68 | 52.73 | 73.22 | 67.9 |
| **Internet (% of popula-** | | | | | | |
| **tion)** | | | | | | |
| **Net primary income** | ######### | ######### | ######### | ######### | ######### | ######### |
| **(BoP, current US$)** | | | | | | |
| **GDP growth (annual %** | 2.93 | 2.14 | 1.16 | 7.26 | 1.89 | 2.77 |
| **)** | | | | | | |
| **GDP (current US$)** | ######### | ######### | ######### | ######### | ######### | ######### |
| **Communications, com-** | 3,51,59,225.20 | 4,40,93,948.25 | 5,39,70,810.39 | 2,64,37,325.60 | 4,71,11,373.43 | 1,92,36,572.08 |
| **puter, etc. (% of ser-** | | | | | | |
| **vice imports, BoP)** | | | | | | |
| **Fixed broadband sub-** | 8,52,970.09 | 10,39,57,166.67 | 3,54,43,552.00 | 30,97,69,041.67 | 1,92,36,572.08 | 46,97,990.40 |
| **scriptions** | | | | | | |
| **Insurance and financial** | 8.57 | 19.06 | 6.9 | 5.29 | 6.88 | 7.33 |
| **services (% of commer-** | | | | | | |



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| | | | | | | |
|---|---|---|---|---|---|---|
| **cial service imports)** | | | | | | |

For example, Cluster 0 regroups a diverse set of countries, including Benin, Belize, Bhutan, Czechia, Bahrain, Bangladesh, Azerbaijan, Chile, Bahamas, Belarus, Cabo Verde, Estonia, Georgia, Ghana, Hon- duras, Dominica, Finland, Fiji, Haiti, Hungary, Cambodia, Lithuania, Kenya, Lebanon, Lao PDR, Kaza- khstan, Montenegro, Pakistan, Oman, New Zealand, Mauritius, Madagascar, Nepal, Paraguay, Morocco, Peru, Namibia, Senegal, Qatar, Eswatini, Rwanda, Uganda, Trinidad and Tobago, Zambia, Zimbabwe, Tunisia, Portugal, Mongolia, Uruguay, Iceland, Algeria, Jordan, Yemen, Sri Lanka, Tanzania, Slovenia, Slovak Republic, Serbia, Romania, Moldova, Malta, Luxembourg, Latvia, Greece, El Salvador, Dominican Republic, Bulgaria, Bosnia and Herzegovina, Bolivia, Armenia, and Angola.

The countries in this cluster share certain characteristics or economic indicators that place them in proximity to each other in a multidimensional space. The ”distance” between these countries in this space is determined by the differences in the values of the various economic indicators included in the K-means clustering analysis. Countries that are closer together in this space have more similar economic profiles based on the selected indicators.

Linking this clustering analysis to the CBDC readiness, one can consider that countries in the same cluster may have similar economic considerations and challenges when it comes to implementing CBDCs. For instance, if countries in Cluster 0 have similar levels of financial inclusion, trade patterns, or economic stability, they might face similar issues and opportunities when it comes to adopting and utilizing CBDCs. Therefore, policymakers and central banks in these countries might find it valuable to share insights and collaborate in the development and implementation of CBDC initiatives to leverage their shared economic characteristics. CBDC can potentially address specific economic needs and challenges within this cluster, such as improving financial inclusion, enhancing cross-border trade, or ensuring stable and efficient payment systems.

**Forward analysis**: In our forward analysis, our focus extended to gaining a granular under- standing of the current CBDC status across different countries. This pursuit naturally led us into the realm of a classification problem. Our objective was to discern and classify CBDC status based on a plethora of economic and social indicators that collectively shape the landscape of digital currency implementation. By leveraging these common indicators, we sought to establish a comprehensive framework for evaluating CBDC progress on a global scale.

To accomplish this, we harnessed the power of advanced data-driven techniques. Among the tools we employed, the CatBoost classification model emerged as a powerful ally. This sophisticated machine learning algorithm demonstrated remarkable prowess in analyzing and categorizing CBDC readiness based on the amalgamation of economic and social indicators. Through meticulous training and rigorous testing, we achieved a remarkable accuracy rate of 86%, attesting to the robustness and effectiveness of our classification approach. Our utilization of the CatBoost model not only provided a refined snapshot of CBDC readiness but also empowered us with actionable insights that can steer strategic decision-making towards successful CBDC implementation in various regions Figure 3.


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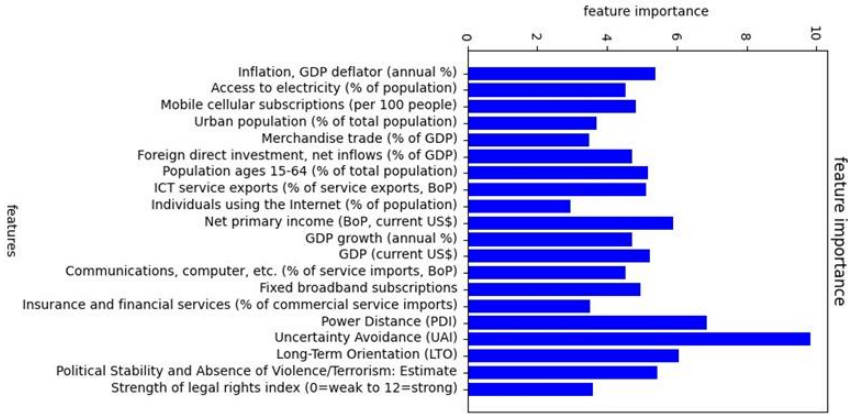


**FIGURE 3**
**FEATURES IMPORTANCE**

The analysis of feature importance has yielded critical insights into the factors that significantly influence the success of a CBDC implementation. Notably, the ”Uncertainty Avoidance Index,” ”Long-Term Orientation,” and ”Power Distance Index” emerge as pivotal determinants of CBDC success, underlining the importance of a country’s cultural and societal attributes in shaping its digital currency landscape. In addition to these sociocultural factors, economic indicators have also assumed a central role in CBDC viability. Key performance indicators (KPIs) related to Gross Domestic Product (GDP), particularly those linked to the Gross Payment Gateway (GPG), have proven instrumental in gauging CBDC effectiveness. Moreover, the ”Foreign Direct Investment Net Inflow % of GDP” serves as a crucial economic metric, highlighting the significance of a robust foreign investment environment in bolstering CBDC triumph. Together, these findings emphasize the multidimensional nature of CBDC success, where cultural dimensions and economic indicators intersect to shape the outcome of digital currency initiatives.

**Comprehensive CBDC readiness analysis**: A Multidimensional Examination The culmination of our meticulous backward and forward analyses has revealed a profound insight: a compre- hensive assessment of a country’s readiness for CBDC implementation demands a holistic consideration of economic, political, legal, and now, social indicators. Through our exhaustive examinations, we have dis- cerned that key economic indicators—such as inflation, access to electricity and the internet, mobile cellular penetration, percentage of imports in the balance of payments (BoP) related to communication and com- puter services, urban population concentration, foreign direct investment net inflows—stand as fundamental in gauging the potential success of CBDC adoption.

However, the story doesn’t end there. Our analysis has also brought to light the undeniable significance of social factors. Indicators like the uncertainty avoidance index and long-term orientation, both embodying aspects of a nation’s social fabric, significantly influence the trajectory of CBDC implementation. As a vivid example, these social metrics play a pivotal role in predicting which countries may lead the transition to digital currency. The relationship between a society’s orientation toward embracing innovation and its aversion to uncertainty provides vital insights into the timing and feasibility of CBDC adoption, particularly in the context of predicting the pioneering nation to embrace digital money.


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In essence, our comprehensive analysis underscores that assessing CBDC readiness extends beyond economic and technological realms to encompass political stability, legal strength, and societal dispositions. This holistic understanding serves as a compass guiding countries towards effective CBDC implementation. As the landscape of global finance continues to evolve, informed decisions derived from this multidimensional perspective stand to pave the way for successful and transformative CBDC integration, ultimately shaping the future of monetary systems worldwide.

While the response's analysis is not a strict PESTEL analysis, it certainly draws from similar principles by considering a broad range of external factors to comprehensively assess the landscape and potential outcomes of CBDC implementation.

## CBDC Radar & Strategic Marketing Targeting

In this section, we will harness the insights derived from the CBDC readiness study to construct a compre- hensive radar chart that highlights key economic and social indicators' growth trajectories over time. This radar chart serves as a powerful tool for evaluating a country's readiness to implement Central Bank Digital Currencies (CBDCs) while minimizing the risk of failure.

By plotting these indicators on the radar chart 4, we can visualize how a country's economic and social landscape has evolved, identifying strengths, weaknesses, and trends. These insights will play a pivotal role in assessing the suitability of a country for CBDC implementation. A higher level of alignment and positive growth trends in these indicators will indicate a lower risk of failure and a more conducive environment for introducing CBDCs.

Furthermore, this analysis will not only guide the evaluation of CBDC readiness but also help identify promising marketing opportunities. Understanding a country's readiness for CBDC adoption allows for more targeted and effective strategies for promoting and implementing digital currencies. By aligning CBDC initiatives with a country's economic and social progress, policymakers and central banks can enhance the likelihood of successful CBDC adoption and its positive impact on the economy and society Figure 4.

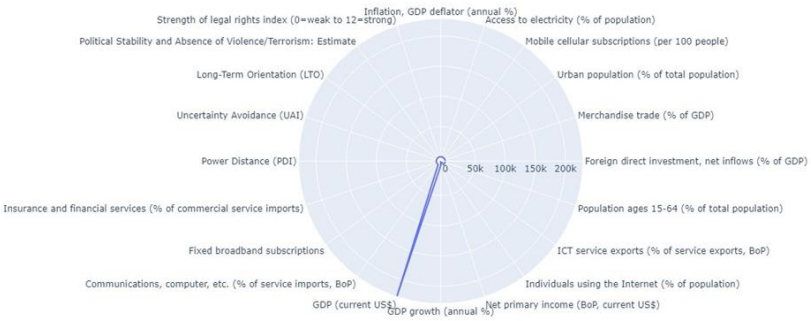


**FIGURE 4**
**CBDC RADAR**

Linking our study 2.1.2.3 to predictive economic growth models allows us to identify potential success op- portunities in the implementation of CBDC. By utilizing economic growth forecasts and trends, we can gain valuable insights into which countries are likely to experience


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favorable economic conditions for CBDC adop- tion. In fact, The predictive models help us pinpoint countries where the introduction of CBDC can align with anticipated economic expansion. This alignment not only reduces the risk of failure but also maximizes the potential positive impact of CBDC on economic development and financial inclusion.

Moreover, this strategic approach extends to marketing efforts. Armed with the knowledge of countries poised for economic growth and CBDC readiness, we can tailor our marketing strategies accordingly. This targeted approach ensures that our efforts are focused on countries with the greatest potential for successful CBDC adoption.

In addition to our economic focus, we also employ Hofstede's social model Hofstede, (2011) to gain a comprehensive understanding of the factors influencing the digitalization of money 2. Within this model, we recognize the significance of indicators like the Uncertainty Avoidance Index and Long-Term Orientation. Starting with the Uncertainty Avoidance Index (UAI), it gauges a society's willingness to embrace ambiguity and deal with uncertainty. In nations with a high UAI, there is a prevalent aversion to risk, and people tend to seek stability and predictability. When planning a CBDC launch in such a context, it becomes essential to design the campaign in a way that addresses these concerns. Highlighting the security and reliability of the digital Maryaningsih et al., (2022).

Currency system, providing clear guidelines for its use, and emphasizing how it can mitigate financial risks may resonate well with the population. On the other hand, the Long-Term Orientation dimension examines a society's focus on long-term planning and perseverance. Cultures with a high Long-Term Orientation tend to prioritize sustainable economic development and value perseverance and thriftiness. When introducing a CBDC, it's beneficial to showcase how digital currency can contribute to long-term economic stability and prosperity. Campaign messages can stress how CBDC aligns with the nation's long-term economic goals and how it fosters a culture of financial prudence. This revelation opens up exciting avenues for future research and work in the field. It underscores the importance of not only economic and technological readiness but also social preparedness for the transition to digital currencies. Future endeavors can delve into strategies and initiatives that help societies adapt to this transformative change, ensuring that CBDC are not only technologically feasible but also socially accepted and beneficial.

## CBDC Readiness: Scoring

In this section, we will leverage the classification outlined in the preceding section to establish a scoring mechanism for assessing readiness. The classification criteria from the earlier section serve as the foundation upon which we will build a numerical scoring system. This scoring system will provide a more quantitative and tangible measure of a country's preparedness to implement a CBDC. By translating the classification criteria into numerical scores, we aim to create a structured and objective approach for evaluating and comparing different countries' readiness levels. This scoring methodology will enhance decision-making processes, allowing policymakers and central banks to make informed choices and prioritize actions to advance their CBDC initiatives effectively.

To do that, we employ the logistic regression objective function, also known as the loss function, for multiclass classification with L1 regularization. The logistic regression objective function for multiclass classification with L1 regularization can be expressed as:


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$$\frac{\min}{\beta}\left[\frac{1}{N}\sum_{i=1}^{N} Loss(\mathrm{y}_{i,}\mathrm{p}(\mathrm{x}_i;\beta)) + \alpha\sum_{j=1}^{p}\left|\beta_j\right|\right]$$

Where:

- N is the number of samples.
- p is the number of features.
- β represents the coefficients (weights) of the logistic regression model.
- yi is the true class label for the i-th sample.
- p(xi; β) is the predicted probability distribution over classes for the i-th sample.
- α is the regularization strength hyperparameter.
- Loss(yi, p(xi; β)) is the cross-entropy loss between the true class label and the predicted probability distribution.

As a result, we can score the countries readiness as follow Figure 5:

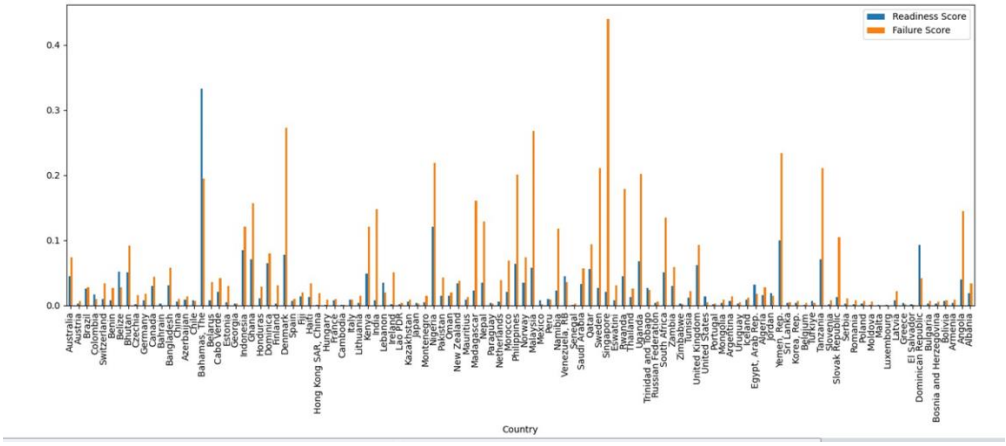


**FIGURE 5**
**CBDC READINESS AND FAILURE SCORES PER COUNTRY**

One such critical metric that underscores the inherent risks associated with implementing a CBDC is its scoring metric. This metric serves as a comprehensive gauge of the potential pitfalls and challenges that lie ahead. It vividly illustrates that CBDC implementation is not without its share of risks and uncertainties. From regulatory concerns and cybersecurity vulnerabilities to economic stability and public acceptance, the scoring metric underscores the need for careful consideration and mitigation strategies.

## Understanding Scoring Interpretation With Real-World Examples

Example 1 For instance, Bahamas is poised for a significant economic transformation as it embraces the digital age and prepares to adopt CBDC reforms. With a rapidly growing economy, various key indicators underscore the nation's readiness for this financial evolution. First and foremost, The Bahamas boasts impressive economic stability, with an annual inflation average rate as low as 1.28%. This stability provides a solid foundation upon which to introduce digitalization reforms. Additionally, the country has achieved a 100% access to electricity, ensuring that the infrastructure needed for a digital economy is already in place. The widespread availability of mobile cellular subscriptions, at a rate of 93.14 per 100 people, showcases the


**Citation Information:** Karoui, I., Kmiha, H. (2024). Social and economic studies of the cdbc readiness. *Academy of Strategic Management Journal, 23*(2), 1-14.

nation's connectivity. Moreover, a high level of internet usage, with 82.83% of the population having access, indicates a digitally engaged society. The Bahamas has also successfully attracted foreign direct investment, with net inflows accounting for 32.54% of its GDP. This influx of external capital can further facilitate the transition to a digital financial system. Urbanization, with 3.99% of the population living in urban areas, provides a conducive environment for the adoption of digital banking and payments. Additionally, the country's commitment to embracing technology is evident in its 69.82% ICT service exports, a promising sign for digital financial services. Furthermore, The Bahamas' political stability, absence of violence or terrorism, and strong legal rights index contribute to a conducive environment for financial reforms. As The Bahamas continues to advance in various economic and technological aspects, the decision to launch CBDC digitalization reforms aligns with its readiness to embrace a digital financial future. This transition promises to usher in new opportunities, enhance financial inclusion, and bolster the nation's economic resilience in the digital era.

Example 2: Tunisia finds itself in a unique position where the probability of success and the probability of failure in adopting digitalization reforms are seemingly balanced, creating a state of quasi-equality. Several key factors contribute to this delicate equilibrium. Firstly, Tunisia exhibits certain strengths that enhance its readiness for digitalization. The nation has a relatively high rate of mobile cellular subscriptions, with approximately 99.81 subscriptions per 100 people. This indicates a widespread access to mobile communi- cation, which is a fundamental element of digitalization. Additionally, the population's access to electricity stands at 119.39%, surpassing 100%, which underscores the robust infrastructure already in place.Moreover,

Tunisia has been making significant strides in attracting foreign direct investment, with net inflows constitut- ing 68.23% of its GDP. This reflects the nation's attractiveness to external capital, which can be channeled into digitalization efforts. A relatively high level of urbanization, at 82.83%, further contributes to Tunisia's readiness, as urban areas are often more conducive to digital transformation.

However, there are notable challenges that introduce an element of probability of failure into the equation. Tunisia's GDP growth rate, at 1.95%, is relatively modest, which could potentially hinder the financial resources required for digitalization initiatives. The nation also faces a substantial deficit of approximately

-132,001,163,6.37 in its balance of payments, which may indicate economic vulnerabilities.

The relatively low rate of internet usage, with only 67.99% of the population having access, poses a hurdle to the widespread adoption of digital technologies. Additionally, Tunisia's score of 8.36 in the Power Distance Index (PDI) suggests some hierarchical barriers that might affect digital transformation efforts.

## CONCLUSION

In this paper, we embarked on a comprehensive exploration of the intricacies involved in project implemen- tation, focusing specifically on the introduction of CBDC. Our study revolved around two pivotal axes: the economic capacity of a country to fund a CBDC initiative and the social awareness and willingness of its populace to embrace asset digitalization, while also considering the intricate political and legal dimensions. Throughout our research, we harnessed the power of AI-driven analysis, enabling us to perform backward

Backward analysis and Forward analysis assessments to better understand the potential outcomes and challenges associated with CBDC adoption.

This study, aptly referred to as "CBDC Radars" 3 serves as a valuable entry point for



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companies and stakeholders looking to devise strategic marketing plans in the realm of digital currencies. By dissecting the economic, social, political, and legal aspects, our research equips businesses with essential insights to navigate this complex landscape successfully.

In conclusion, we culminated our efforts by introducing a pioneering scoring gauge, a CBDC readiness/failure indicator 4, designed to shed light on the preparedness of a nation for CBDC implementation. This scoring metric encapsulates the multifaceted dimensions explored in this paper and offers a comprehensive overview of the risks and opportunities inherent in the adoption of a Central Bank Digital Currency. As we stand on the cusp of a digital financial revolution, this research underscores the need for thorough analysis and strategic planning to ensure the successful integration of CBDCs into our ever-evolving financial landscape.

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**Received:** 04-Jan-2024, Manuscript No. ASMJ-24-14358; **Editor assigned:** 05-Jan-2024, PreQC No. ASMJ-24-14358(PQ); **Reviewed:** 19- Jan-2024, QC No. ASMJ-24-14358; **Revised:** 22- Jan -2024, Manuscript No. ASMJ-24-14358(R); **Published:** 29- Jan-2024



**Citation Information:** Karoui, I., Kmiha, H. (2024). Social and economic studies of the cdbc readiness. *Academy of Strategic Management Journal, 23*(2), 1-14.