

## Article

# Conceptualization of DIANA Economy and Global RPM Analysis: Differences in Digitalization Levels of Countries

Ji Young Jeong <sup>1</sup>, Mamurbek Karimov <sup>1</sup>, Yuldoshboy Sobirov <sup>1</sup>, Olimjon Saidmamatov <sup>2,\*</sup>  
and Peter Marty <sup>3,\*</sup>

<sup>1</sup> Department of International Trade, Jeonbuk National University, Jeonju-si 54896, Republic of Korea; j3021@jbnu.ac.kr (J.Y.J.); mamurbek@jbnu.ac.kr (M.K.); syuldoshboy@jbnu.ac.kr (Y.S.)

<sup>2</sup> Faculty of Socio-Economic Sciences, Urgench State University, Urgench 220100, Uzbekistan

<sup>3</sup> Institute of Natural Resource Sciences, Zurich University of Applied Sciences (ZHAW), 8820 Wädenswil, Switzerland

\* Correspondence: saidolimjon@gmail.com (O.S.); marp@zhaw.ch (P.M.)

**Abstract:** The economics of globalization are changing due to digitization. The increasing global scope of digital platforms is lowering the cost of cross-border communications, allowing companies to connect with customers and suppliers across borders. This leads to the emergence of new competitors from anywhere in the world, increasing competition within an industry. The main objective of this research was to conduct an analysis of the DIANA Economy and Global RPM and to examine the various definitions and concepts of measuring the digital and analog economies in a comprehensive approach. Furthermore, this study analyzes and ranks the changes that countries around the globe have seen in their digital competitiveness, presenting the foundations of analog and digital economies and refining their definitions. Based on the results, most countries, 41 out of 60, are analog and analog, which implies that they rely on an analog economy and need to develop digitalization strategies to transition from analog to digital. By providing rankings, policy implications, and strategies tailored to different population categories, it offers a roadmap for countries and businesses seeking to thrive in an increasingly digitalized world.

**Keywords:** DIANA Economy; global RPM analysis; digitalization; analogization; digital competitiveness



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## 1. Introduction

The three significant industrial revolutions, namely mechanization, electrification, and automation, represent crucial milestones signifying important socio-economic advancements in human history [1]. Presently, alongside the fourth industrial revolution, the term “digital transformation” has gained prominence in the context of policymakers, the scientific community, and businesses [2–4]. This is because it has been reshaping the foundational socio-economic structures [5–7]. Although there exists a lack of consensus regarding the optimal approach to harnessing digital advancements, numerous countries and most industries have devised strategies and approaches to enhance their competitive positions in this transformative race [8–12]. Moreover, the global economic shift towards digitalization is intimately connected with the introduction of new technologies and is often referred to as the fourth industrial revolution [13,14]. The impact is not only economic but also social and political [15]. Additionally, digital transformation is not just a technological shift but also a fundamental driver of economic growth, competitiveness, and sustainability in today’s interconnected world [16]. Businesses and governments that prioritize and invest in digitalization are better positioned to thrive in the digital economy [17]. Furthermore, the digital economy is a driving force in today’s world, impacting nearly every aspect of society and the economy [16]. Embracing digitalization and understanding its importance is crucial for individuals, businesses, and governments to thrive and remain competitive in an increasingly interconnected and technologically driven global landscape.

However, it is important to note that although the digital economy continues to grow and evolve, the analog economy remains vital because it represents the real production and consumption of goods and services, especially in today's digital age [18]. Events such as economic downturns, geopolitical tensions, political issues, and health crises can have a negative effect on markets and bring about widespread fluctuations, thus having an adverse impact on digital economies and companies as well [19,20]. In addition, disruptions in technology, shifts in user behavior, investors' sentiments because of news, trends, and market dynamics, or changes in business models can have an effect on revenue and earnings projections, causing fluctuations in stock prices [21]. An analog economy also provides jobs, income, and wealth for millions of workers, entrepreneurs, and investors [22]. Therefore, it is vital to understand and support the analog economy in order to achieve balanced and inclusive development. While the digital economy is an essential part of the architecture of the fourth industrial revolution that offers numerous advantages in terms of efficiency, speed, and convenience, it is important to recognize that the analog economy can contribute more to societal diversity, cultural richness, and the well-being of individuals who engage in or rely on traditional methods of economic activity [23]. The analog economy serves as the base for the growth of the digital economy, while the digital economy acts as a booster for the analog economy [24]. Additionally, achieving high-quality economic growth requires the advancement of the digital economy to support the transformation and enhancement of the analog economy [25]. In summary, whether a country is predominantly analog or digital, this is not a measure of its overall quality or superiority [26]. A balance between analog and digital approaches can be achieved to address the specific needs and priorities of each country, and both analog and digital countries have opportunities for growth, development, and improvement.

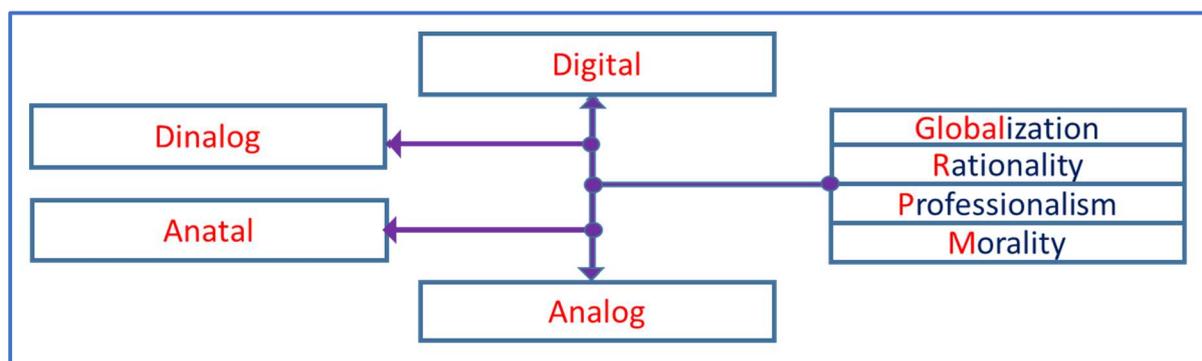
The concept of the DIANA economy is related to the phenomenon of the fourth industrial revolution that implies a change in industrial development capable of generating important changes to develop more efficient and sustainable industrial installations and processes. As DIANA economy focuses mostly on digital and analog environments from the perspective of industrial convergence that is introduced for the very first time. The digital economy and the analog economy are interdependent and mutually reinforcing, which will eventually achieve high-quality economic development [27,28]. The DIANA economy is important because it provides a comprehensive framework for businesses, industries, and countries to navigate the challenges and opportunities presented by the ongoing digital transformation and the fourth industrial revolution. In today's fast-paced and rapidly changing market conditions, businesses need to adapt and evolve to stay competitive and thrive. The DIANA economy provides a roadmap that businesses can use to assess their performance, competition, risk, and potential in the digital–analog spectrum. By monitoring the factors that affect the business, such as global trends, economic conditions, and social and environmental factors, businesses can adapt and adjust their strategies to remain competitive and sustainable. Furthermore, global RPM analysis is an important tool for businesses to evaluate and optimize their operations, make informed decisions, and stay ahead of the curve in an increasingly competitive and dynamic global market. Furthermore, through the application of a global RPM analysis for digitalization, countries can gain a holistic understanding of their digital strategies. This approach ensures that digital transformation is not solely driven by technology but also considers global reach, rational decision-making, professionalism, and ethical considerations—all of which are essential for successful digitalization in today's interconnected world.

This research aimed to apply the DIANA economy and global RPM frameworks to analyze and compare the different definitions and parameters of the digital and analog economies in a comprehensive way. These frameworks provide a holistic perspective to understand and succeed in today's dynamic and digitized business environment. Moreover, this research analyzed and ranked the differences that countries around the globe have experienced in their digital competitiveness, presenting the foundations of analog and digital economies and refining their definitions. As the DIANA economy explores the concepts

of digital and analog environments, governments can design appropriate strategies for their specific needs and challenges by identifying their position within this framework. Meanwhile, the global RPM analysis enables countries to develop strategies that emphasize globalization methods, rational economic decision-making, professionalism, and moral considerations by evaluating the four dimensions comprehensively. Furthermore, this paper categorized the countries into three groups according to their population size: large, mid-sized, and small. Moreover, the purpose of this paper is to present the DIANA economy and global RPM analyses for assessing the level of digital development in a country, industry, or human capital, which can be applied to various business levels to build and adjust strategies and plans for adoption and implementation of digital transformation and the fourth industrial revolution. Through our research, our objective is to contribute to a better understanding of the digital and analog economies' coexistence and interdependence on economic development and sustainability. By utilizing the DIANA economy and global RPM frameworks, the goals of this study are to provide practical tools for policymakers and stakeholders to make informed decisions aimed at shaping the digital future of countries, adapting their strategies, and thriving in today's interconnected and technologically driven global market.

## 2. Conceptualization of the DIANA Economy and Global RPM Analysis

The economics of globalization are changing due to digitization. The increasing global scope of digital platforms is lowering the cost of cross-border communications, allowing companies to connect with customers and suppliers across borders. This leads to the emergence of new competitors from anywhere in the world, increasing the competition within an industry. Global RPM analysis is a strategic planning tool of the DIANA economy that is used when countries or industries consider implementing a major change, such as adopting a new business model or starting a digital transformation. It is essential to document the current situation to establish the basis of the digitalization process. By performing an analysis of the DIANA economy and global RPM, decision makers can gain a more comprehensive understanding of the key factors that could influence the outcome of a proposed action (Figure 1).



**Figure 1.** DIANA economy and global RPM analysis [29].

There are various analyses that are required when a business is run, from small businesses to large industries. Several methods can be used in order to reach an assessment about a business' current state and to make an informed decision based on that assessment. The DIANA economy and global RPM analysis can be used significantly by countries and companies. Business owners can implement these methods in order to determine where their venture stands in terms of growth. The DIANA economy and global RPM analysis' applications are not limited to companies or industries only. It is possible to implement the frameworks for products, places, and even human capital. Moreover, regardless of whether a business is new or established, it can be used by both.

### 2.1. DIANA Economy

The DIANA Economy is an acronym for digital (DI) and analog (ANA) that is a framework for how a business experiences significant changes as it engages digital transformation and the fourth industrial revolution [29]. The model was first introduced by Professor Jeong, J.Y. at Jeonbuk National University in the year 2015. The DIANA economy framework is central to economic growth, which also focuses on more than digitalization and provides a common reference point that can evolve as the business changes. By using this framework, countries and industries can develop strategies and roadmaps that enable them to adapt and compete in the rapidly changing market conditions of digitization processes by identifying socio-economic conflicts between digital and analog societies [30].

The DIANA economy examines the digital, dinalog, anatal, and analog environments that affect industries and companies. For the digital environments, countries have a high level of digital expertise, and they are also moving forward at a very rapid pace. Dinalog countries have achieved a significant degree of digital progress while making steadily increasing enhancements. Anatal describes countries that are growing and improving rapidly but still have a low digital transformation score. Finally, analog countries have achieved a significant degree of digital progress while making steadily increasing enhancements. Furthermore, the DIANA economy is a technique which is based mainly on digital and analog concepts to evaluate the productivity, competitiveness, risk, and opportunities of a business, as well as parts of a business such as a product line or division, an industry, another entity or human capital for each area, and all the related competences, providing a general description for each competency.

Figure 2 shows the DIANA economy model, which mainly consists of four concepts (digital, dinalog, anatal, and analog). This model can be used not only for a business or industry, but also for countries, companies, and even human capital to provide strategies and recommendations according to their position in the DIANA economy. This is done by analyzing which one is closer among the four concepts after learning their places. A country or company may not be completely digital or analog. As we can see, the digital model can be 90 percent digital and 10 percent analog, and vice versa for analog. Dinalog usually involves a large share of digital, with a 70 percent or less share of analog. Conversely, anatal involves a 30 percent share, as shown in Figure 2 [31].

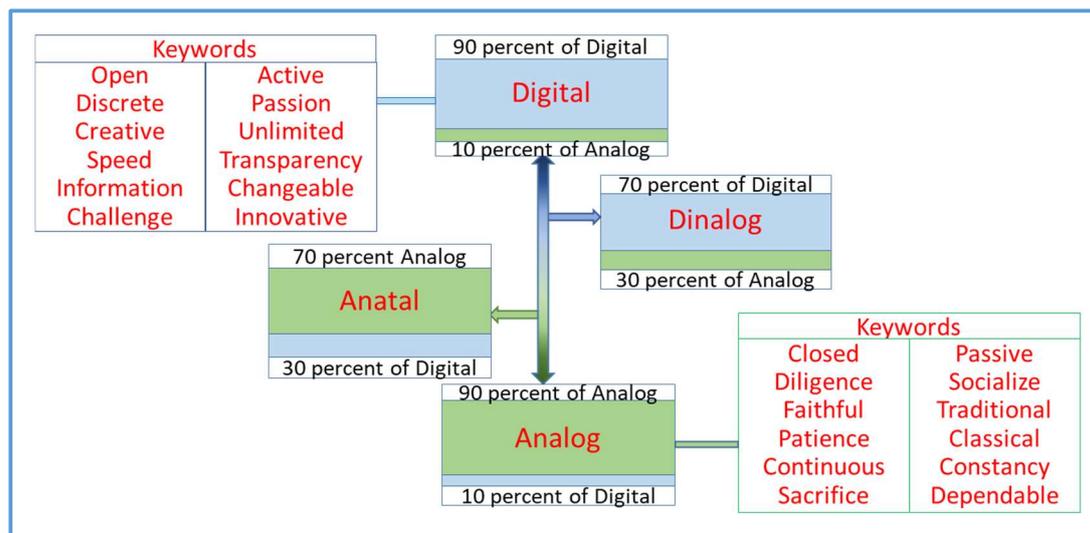


Figure 2. DIANA economy [29,30].

The choice of keywords for the digital and analog economies provides a clear distinction between these two economic paradigms. For example, the keyword “active” usually characterizes the dynamic and proactive nature of the digital economy, reflecting the constant innovation, adaptability, and quick responses to changing market conditions.

Conversely, “passive” mainly represents the traditional and steady approach of the analog economy, emphasizing continuity and adherence to established practices with a preference for stability over rapid change. Furthermore, in the digital economy, keywords such as “open”, “creative”, and “speed” highlight the dynamic and innovative nature of digital operations. Openness, both in terms of data accessibility and open-source principles, fosters creativity and the rapid pace at which digital processes evolve. “Challenge” underscores the competitive and ever-changing landscape of digital markets, and “passion” reflects the enthusiasm and drive of those involved in digital innovation, which can help people overcome the challenges and uncertainties that come with the rapid changes and innovations in the digital world. Terms like “unlimited” and “innovative” emphasize the boundless possibilities and continuous innovation that define digital economies. On the other hand, the keywords for the analog economy, such as “closed”, “faithful”, and “traditional”, underline its adherence to established practices and traditions. The keyword “sacrifice” embodies the idea of the analog economy’s willingness to invest time, effort, and resources in maintaining established processes, systems, and traditions by preserving existing practices and values. “Diligence” and “patience” highlight the meticulous and steady approach of analog economies, which may involve longer business cycles and processes. “Socialize” points to the importance of social relationships and community interactions, which play a central role in analog economies. The term “constancy” signifies the focus on stability and reliability in these systems, and “dependable” reflects the emphasis on trustworthiness and predictability. These keywords collectively paint a picture of a sharp contrast between the fast-paced, innovative, and open digital economy and the traditional, stable, and community-oriented analog economy. However, it is essential to recognize that real-world economies often exhibit a blend of these characteristics, and the keywords are a simplification of complex economic systems.

In addition, it should be noted that the percentage scores obtained by dividing countries by the DIANA economy’s four concepts (digital, analog, analog, and dinalog) are not static, and different research areas may employ different methodologies and weightings based on their specific goals and objectives to adjust their assessments according to their specific objectives and goals. Additionally, the appropriate percentage of the frameworks can be calculated and applied independently based on the study methodology. As a first step toward applying and calculating the DIANA economy framework, it may be necessary to identify the relevant competencies in each environment and then to measure them using the appropriate indicators. For example, some possible competencies for the digital environment are innovation, creativity, agility, collaboration, and data literacy, while other potential indicators include patents, R&D expenditure, start-up activity, digital skills, and internet connectivity. The data sources can be official statistics, surveys, reports, or other reliable sources. The indicators can be normalized and weighted to create a composite index for each competency. Then, the competencies can be aggregated to create a score for each environment. The score can be expressed as a percentage or a rank. The framework can be used to compare different entities across the four environments and to identify their respective advantages and disadvantages for improving their performance and competitiveness in the DIANA economy. It can also be used to monitor their progress over time and to evaluate the impact of policies or interventions on their digital transformation. Moreover, to better understand the DIANA economy, it may be better to know definitions of digital and analog. In Figure 2, we can see the components and short definitions of digital and analog. Moreover, while digital can be seen as active, analog can be passive.

### 2.1.1. Digital and Analog

To define the concepts of analog and digital, it is important to understand the analog and digital economies on which they are based. An analog economy makes predominantly physical products and services that all people buy and sell in the system of production, distribution, exchange and consumption [32]. By itself, the digital economy does not produce generally material goods (food, clothing, equipment, motor fuel, etc.), but instead

creates conditions for the more efficient production of these goods such as online courses, non-fungible tokens, digital transactions with digital cash, and online and mobile games, predetermining progress in all spheres of the national economy [33,34]. Digital and analog economies are fundamentally different from each other in many parameters, the most important of which are, in our opinion, the following: the main resource of the economy; the prevailing type of economic ties in the economy and organizations, markets, sales of products; the rate of change in the economy; uncertainty and risk; and changes in the labor market [35]. The differences between these parameters in the digital and analog economies are considered.

Digital refers to the representation of physical objects or actions using binary code. When employed in a positive sense, it characterizes the frequent use of the most up-to-date digital technologies to enhance organizational processes, to foster interactions among individuals, companies, and objects, or to enable innovative business models. Conversely, analog stands in contrast to digital [36]. It describes any technology, such as analog clocks with physical hands or vinyl records, that operates without breaking down functions into binary code. Everything emerging from a digital process, on the other hand, bears no resemblance to the initial binary code input. Analog can be demonstrated by a watch that employs physical hands traversing its face to indicate the time, as opposed to displaying digital numerical figures.

“Analogization” could therefore refer to the process of making something more analog in nature or using analog technology or methods to accomplish a task or solve a problem [29,37]. Moreover, analogization can refer to the process of incorporating analog elements into a primarily digital business model or strategy. For example, a company that has been relying solely on online sales may decide to open a physical store to provide a more tangible experience for its customers. This is an example of analogization, as the company is adding an analog component to its primarily digital business model. Another example of analogization in the economy is the integration of digital technologies in traditional analog industries such as agriculture or manufacturing. By incorporating sensors, automation, and other digital tools, these industries can increase their efficiency and productivity while maintaining the human touch and experience that comes with analog practices [35,38]. Overall, analogization involves finding a balance between the benefits of digital technologies and the value of analog practices in the economy. It can help businesses and industries to remain competitive and adaptive in the rapidly changing market conditions of the modern economy. Moreover, by combining digital and analog technologies, analogization can create a bridge between new and old systems, allowing for enhanced compatibility between different technologies and systems [30]. This can help companies to respond more quickly to changing market conditions and customer needs.

As a way to better understand the analog and digital concepts, we can see digital as a two-digit number system consisting of one (1) and zero (0), while analog is a ten-digit number system (0 1 2 3 4 5 6 7 8 9). Digital can be rapidly changed from 0 to 1 or vice versa. However, analog can take longer to change from 2 to 5, for example. As mentioned above, changing something is difficult for analog, which can be a country, company, or industry such as tourism or agriculture [30].

Analog economies typically offer more physical products and services that are tangible, whereas the products and services of digital economies are mostly produced using digital technologies, such as the internet, cloud computing, artificial intelligence, or the internet of things [39]. These products are specialized in digitally enhanced tangible goods and embedded digital services [40]. Digital economies offer faster and more convenient transactions than analog economies [36]. In digital economies, transactions can be completed in a matter of seconds or minutes, whereas in analog economies, transactions can take days or weeks to complete. Furthermore, in digital economies, transaction records are stored on the block chain, providing a public and immutable record of all transactions. This requires sophisticated digital infrastructure, such as high-speed internet and advanced telecommunication networks, whereas analog economies rely on physical infrastructure, such as

roads and transportation systems. Physical barriers such as distance and location, on the other hand, might limit analog economies. Digital economies can reach a global market in a very short amount of time, whereas analog economies have a more limited market reach which is often confined to local or regional areas [34]. However, Analog economies offer more social interactions than digital economies. In analog economies, people often engage in face-to-face interactions while exchanging goods and services. Digital economies, on the other hand, rely on digital interactions, which can be less personal and more impersonal. Overall, the choice between an analog and digital economy depends on various factors, including the type of goods or services being exchanged, market demand, and cultural context [37]. Both types of economies have their strengths and weaknesses, and the most effective approach will depend on the specific needs and goals of the individual or business [41].

### 2.1.2. Dinalog and Anatal

Anatal and dinalog are two concepts that are part of the DIANA economy model. These represent different degrees of digitalization and analogization in economies. Anatal and dinalog concepts are important parts of the DIANA economy model. This model consists of digital and analog models and can be used for countries, companies, and human capital to provide strategies and recommendations based on their position in the DIANA economy. Anatal refers to economies that are in the early stages of digitalization and have significant room for growth in this area. These economies may still rely heavily on traditional analog methods and technologies, but they can evolve rapidly as digital technologies become more accessible and affordable. Dinalog, on the other hand, refers to economies that are highly digitalized, but they still may retain some elements of analog methods and technologies. These economies may have reached a certain level of digitalization, but they are not yet completely digital and may still require analog methods to function properly.

It can be often observed that a dinalog economy can emerge as a natural progression when an anatal economy reaches a certain level of development. From one perspective, the effective functioning of an anatal economy can serve as a strong foundation for a dinalog economy. Consequently, the stability of a dinalog economy is closely associated with the potential conversion of digital capital into tangible anatal assets.

Dinalog economies have achieved a high degree of digital development and adoption across different sectors of the economy and society and have strong momentum in continuing to advance their digital capabilities. These countries have high scores in all dimensions or indicators of digitalization, such as connectivity, human capital, use of internet services, integration of digital technology, or digital public services. It can be essential for these economies to actively enhance their competitiveness, invest in emerging digital technologies where they mostly have a competitive advantage, and remove obstacles to innovation. In order to maintain growth driven by innovation, dinalog economies may consider digital economies as a way forward. Furthermore, an observation can be made that dinalog economies might place a strong emphasis on factors such as sustained social equity, inclusion, and a culture of trust, potentially favoring these values over rapid growth. While it is possible that they hold positive views about technology and digital transformation and they may experience some level of digital integration, these claims should be considered in the context of their potential socio-economic objectives and strategies.

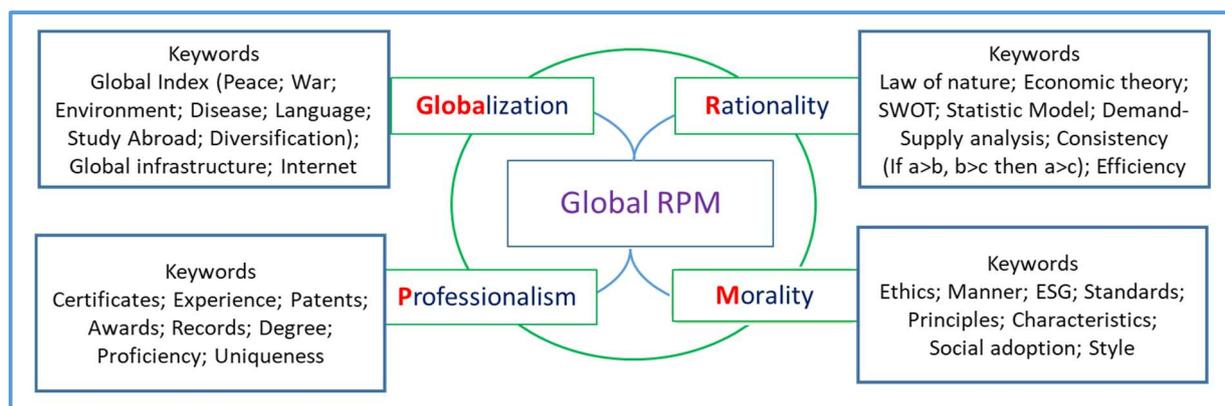
Anatal economies are less advanced on digitalization in their present state, but they often improve rapidly. In such economies, both traditional industries, which may rely on conventional methods and technologies, and digital sectors, which partially leverage digital technologies, contribute to the overall economy. Furthermore, these countries can leverage their unique strengths and resources in traditional economic sectors while slowly adapting to the digital era. Anatal economies may tend to be less susceptible to global economic fluctuations and shocks, as they are not heavily integrated into the global digital market. Investments would be highly attracted to anatal economies due to their growth

potential. Analog economies demonstrate a generally optimistic perspective regarding technology and digitalization.

The fundamental direction and guiding principles of contemporary economic development revolve around the globalization of economic activities. This involves enhancing the integration of diverse sectors within the economy, facilitated by the emergence of the global information age. Knowing analog and digital or dinalog and anatal state of a business and capitalizing on them can lead to better achievements. Successful countries are built by building a system where industries can contribute to their full capacity. By surrounding an economy which is able to capitalize on the strengths of smart and driven strategies and provide support, it will develop a culture that yields a great deal of success.

## 2.2. Global RPM Analysis

The global RPM analysis was first proposed by Professor Jeong, J.Y. in 2018 at Jeonbuk National University [30]. Global RPM stands for globalization, rationality, professionalism, and morality, which are four dimensions that enable individuals or groups to assess and improve the critical factors related to successful performance in a business environment. By using global, rational, professional, and moral evaluation, this framework provides an opportunity for a company, product line, division, industry, or other entity to increase its competitiveness in today's market and to view local and global strategies from different perspectives (Figure 3).



**Figure 3.** Global RPM analysis [29,30].

We can use global RPM analysis to evaluate how to become an international brand and to globalize businesses in a globalization dimension, as well as how to reasonably to establish and benefit from a business in rationality dimension, how to professionally develop the business process in professionalism dimension, and how to consider suitable decisions to the society and moral concepts in a morality dimension. Therefore, we can reduce the chances of failure in the future by understanding every aspect of a business without focusing on only rational factors. The holistic model recognizes that globalization affects not only the economy but also culture, politics, and social values. It acknowledges that rationality is not just a matter of efficiency and productivity, but it also involves the human experience and subjective perceptions. It understands that professionalism is not just a matter of technical expertise but also involves ethical considerations and social responsibility. In addition, it recognizes that morality is not just a matter of individual beliefs but also involves the broader social norms and values that shape human behavior.

Globalization, as part of global RPM, is a term employed to identify the increasing interconnectedness of the world's economies, cultures, and populations. This connectivity arises from international trade in products and services, technological advancements, and the movement of investments, individuals, and data across borders [38]. When we mention

globalization factors, we are referring to the strategies and approaches that a business or company can utilize to achieve success in various markets and locations.

Rationality refers to the use of reason and logic in decision-making, with the aim of achieving the most efficient and effective outcome. Rational decision-making involves a systematic and analytical approach to problem solving, with a focus on identifying and evaluating all available options, weighing the costs and benefits of each option, and selecting the option that is most likely to achieve the desired outcome. Rationality is often associated with the use of scientific and data-driven approaches to decision-making, as well as with the use of formal models and quantitative analyses. However, rationality can also be applied in a more intuitive and practical way, involving a careful consideration of all relevant factors and the use of sound judgment and common sense.

Professionalism relates to the level of competence, expertise, or qualifications anticipated from a professional. It also involves adhering to a defined set of standards, guidelines, or a set of qualities that differentiate acceptable practices within a particular field. Business models are used to inform strategic decisions, such as market entry, pricing strategies, and resource allocation. Professionalism ensures that these decisions are based on accurate and well-founded models [39,40]. Professionalism is essential for building credibility, maintaining ethical standards, and making informed decisions. It fosters trust among stakeholders, supports effective communication, and contributes to the long-term success and sustainability of a businesses.

Morality represents a set of guidelines that establish principles governing the behavior and interactions of companies, businesses, individuals, and groups in relation to the environment and various stakeholders or institutions [41]. Within the context of a global RPM analysis, morality includes a broad range of interconnected moral, economic, environmental, and social considerations [42,43]. It involves a comprehensive examination of the fundamental topics and discussions regarding sustainable development within the modern global and professional landscapes. This field explores how businesses should respond to moral issues and contentious circumstances.

By using the global RPM analysis model, individuals and organizations can gain a better understanding of the complex forces that shape modern society. They can use this understanding to inform decision-making, anticipate potential challenges and opportunities, and promote positive change. For example, in the context of globalization, the analysis might draw on economic theories of international trade and investment to understand the drivers and effects of global economic integration. In the context of rationality, the analysis might draw on behavioral economics and psychology to understand how individuals make decisions and the factors that influence their choices. In the context of professionalism, the analysis might draw on organizational theory and management studies to understand how professional roles are structured and how they contribute to organizational performance [44]. In addition, in the context of morality, the analysis might draw on ethical theories, environmental issues, sustainable goals, and cultural studies to understand how moral values are shaped and transmitted in different societies and how they affect individual and collective behavior. Overall, while globalization, rationality, professionalism, and morality are not an economic model themselves, they can be analyzed within the context of various economic models and theories. This model takes a comprehensive and interdisciplinary approach within the broader context of social, economic, and political systems. By using the globalization, rationality, professionalism, and morality holistic model, individuals and organizations can gain a deeper understanding of the complex forces shaping modern society. They can use this understanding to develop more effective strategies and policies that take into account the interconnectedness of these forces and their impact on society as a whole.

Global RPM analysis sets itself apart from other planning tools by offering the flexibility to employ its four dimensions—globalization, rationality, professionalism, and morality—either collectively or individually to assess various aspects of a business. Unlike other methods, there is not one dominant dimension; instead, each dimension can

be applied to any sector of the economy to identify opportunities for profitability and attractiveness. In particular, global RPM examines and tracks the macro–micro environmental factors affecting a company, as each business possesses distinct characteristics and conditions. It is beneficial to have a well-rounded view of the many factors that could affect a business. In order to make the best decisions for a business, it is beneficial to have an understanding of as many factors as possible. For this reason, we performed a global RPM analysis for our chosen businesses to identify advantages, disadvantages, limitations, and influences.

Global RPM analysis can be used for digitalization because it provides a comprehensive framework for evaluating various dimensions of a business or economy, including those that are highly relevant to digital transformation. Digitalization often involves expanding a business's reach to global markets. The globalization dimension of global RPM helps to assess how well a business can succeed in different markets and places. It considers factors such as global rankings, international infrastructure, the internet, and international trade, all of which are crucial in the digital age [45]. Digital businesses can leverage technology to reach a global audience, and the globalization dimension helps evaluate their strategies in doing so. Moreover, digitalization requires rational decision-making processes, including understanding the economic feasibility and utility of digital initiatives. The rationality dimension of global RPM assesses the economic decision-making process, which aligns with the need for businesses to make sound investments in digital technologies. Analytical tools like SWOT and PESTLE, which are part of this dimension, can help evaluate the rationality of digitalization strategies. Furthermore, digitalization is often associated with high levels of professionalism, especially in technology-driven industries. This dimension of global RPM focuses on competence, skills, adherence to standards, and characteristics that distinguish acceptable practices in a specific field. In the context of digitalization, professionalism encompasses the technical expertise required for implementing digital solutions, complying with industry standards, and ensuring data security and privacy. Importantly, ethical considerations become crucial, as digitalization impacts society and the environment. The morality dimension in global RPM includes factors related to ethics, environmental and social governance (ESG), and adherence to principles and standards [39]. In the digital realm, this dimension assesses a business's ethical stance regarding data privacy, cybersecurity, responsible AI usage, and its overall impact on society and the environment. In summary, global RPM analysis offers a comprehensive and adaptable framework that considers multiple dimensions relevant to digitalization. It not only helps in evaluating digital strategies but also supports adaptability, risk assessment, benchmarking, sustainability, and stakeholder alignment, making it a valuable tool for countries embarking on their digital transformation processes.

### **3. Application to Digitalization Levels of Countries**

#### *3.1. Research Design, Data Collection, and Analysis*

This research study's main objective is to conduct a DIANA economy and global RPM analysis of selected countries to explore where they currently stand in terms of digitalization and analogization for adapting, thriving, and addressing the challenges of an increasingly interconnected and technology-driven world while being an appropriate method for situations of strategic planning. Therefore, the DIANA economy and global RPM analysis allow policymakers to obtain a combined view of globalization, rationality, professionalism, and morality of their countries. Since both frameworks analyze the environment based on different factors, the digitalization and analogization processes can provide a holistic view of the drivers of innovation, economic growth, and improvements in various aspects of modern life. Each tool complements the other, allowing for a broader analysis of the environment when used together. When both approaches are applied together, it is possible to understand how the dimensions of the DIANA economy will increase its opportunities globally, rationally, professionally, and morally.

In particular, this study measures the current situations of 60 countries in the digitalization progress, which is based on three sectoral dimensions covering government, industry, and human capital, with each dimension assigned an equal weight. Each dimension plays a distinct yet interdependent role in shaping the overall digital landscape. Recognizing the significance of these dimensions, this research assigns equal weight to each, acknowledging their equal contribution to a country's digital transformation. Additionally, the objective is not merely to assess digitalization progress, but more importantly, to provide actionable insights and policy recommendations. These insights are designed to empower policymakers, industry leaders, and educators, offering them a comprehensive perspective on their country's digitalization process. While the policies, regulations, and initiatives set forth by governments can either catalyze or hinder the diffusion of digital technologies, assessing the digital maturity and adoption rates of industries within a country provides profound insights into their competitive edge on the global stage. Most importantly, at the heart of every digital transformation is a country's human capital. The digital age imposes unique demands on the workforce, necessitating adaptability, technical proficiency, and digital literacy. Therefore, these insights are designed to empower policymakers, industry leaders, and educators, offering them a comprehensive perspective on their country's digitalization path. These three dimensions, each playing a distinctive yet interconnected role, form the foundation of a country's digital transformation. The combination of the global RPM analysis and the DIANA economy enables policymakers to horizontally analyze the connections between each indicator of globalization, rationality, professionalism, and morality in relation to government, industry, and human capital.

Moreover, we disaggregated the countries into three subgroups, which are countries with large, mid-sized, and small populations. Accordingly, there were 20 countries in each of the three groups, for a total of 60 countries represented within the analysis. For each group of countries, we chose the top 20 countries based on their GDP as a criterion for analyzing their digitalization levels, providing a structured and informative perspective on the relationship between economic strength and technological advancement. Namely, this criterion can help elucidate how countries with varying economic capacities approach digitalization and provides insights into their readiness, investments, and strategies in embracing the digital age. Furthermore, the choice to examine countries with diverse population sizes—large (more than 50 million), mid-sized (between 15 million and 50 million), and small (less than 15 million)—in the context of their roles in digitalization is rooted in the recognition of the unique dynamics and implications that population size can have on a nation's digital transformation. In fact, countries with populations exceeding 50 million face the challenge of serving diverse and often geographically dispersed citizenry. They must invest heavily in digital infrastructure, digital literacy, and e-governance to meet the needs of their vast populations. Meanwhile, countries with populations between 15 million and 50 million strike a balance between scale and agility. They have the potential to excel in niche industries, foster innovation, and manage the digital divide more effectively. Additionally, countries with populations of less than 15 million often exhibit nimble governance structures and may prioritize targeted digital initiatives. Smaller nations can achieve higher levels of digital inclusion and innovative solutions. Their small scale allows for efficient resource allocation. By studying countries across the spectrum of population sizes and volume of GDP, we gain valuable insights into the diverse strategies, challenges, and achievements in digitalization. This allows us to appreciate the multifaceted nature of the global digital landscape and fosters a deeper understanding of how nations of varying sizes and economic capabilities play pivotal roles in shaping the digital environment.

We chose the following 60 countries:

- Countries with large populations, namely United States, China, Japan, Germany, United Kingdom, India, France, Italy, South Korea, Russia, Brazil, Spain, Mexico, Indonesia, Turkiye, Thailand, Nigeria, Argentina, Egypt, and Bangladesh.

- Countries with mid-sized populations, namely Canada, Australia, The Netherlands, Saudi Arabia, Poland, Malaysia, Chile, Romania, Peru, Kazakhstan, Morocco, Ecuador, Sri Lanka, Guatemala, Ghana, Cote d'Ivoire, Uzbekistan, Angola, Cameroon, and Nepal.
- Countries with small populations, namely Switzerland, Sweden, Belgium, Austria, Ireland, Norway, Denmark, United Arab Emirates, Singapore, Finland, Hong Kong (China), Czechia, Portugal, New Zealand, Greece, Hungary, Qatar, Cuba, Slovakia, and Kuwait.

To assess the level of digitalization of these countries and to determine the similarity between them, it was necessary to choose appropriate indicators. To choose appropriate indicators of global RPM, a purposeful sampling method was used [40] to deliberately select a sample of participants which had a firm association with a digital economy and digital transformation and adequately understood its functional and operative requirements. Moreover, 31 in-depth interviews were conducted with participants from four groups, i.e., policymakers—7, scientists—9, IT engineers—5, and digital business owners and specialists—10. Then, the DIANA economy and global RPM analyses were performed to identify the key indicators. Consequently, this study identified four dimensions of the global RPM analysis based on experts' interviews and previous literature. Each dimension consisted of three indicators in the appropriate case of global RPM and 12 indicators. In addition, each of the four indicators from the government, industry, and human capital dimensions of the DIANA economy were adopted to measure the global RPM's affective evaluation. All of the indicators used in this study can be seen in Table 1.

**Table 1.** Relevant indicators for global RPM analysis for the digitalization levels.

	<b>Globalization</b>	<b>Rationality</b>	<b>Professionalism</b>	<b>Morality</b>
Government	Global connectivity	E-government development	Open government data	Internet freedom
Industry	High-technology exports	Online creativity	Online access to financial account	Green and sustainable development
Human Capital	Research and development	Knowledge-intensive employment	digital skills	Control of corruption

Source: Constructed by the authors.

In order to determine where the countries were in relation to the digital economy, a number of data points were used as a basis for the analysis. All the data are public and available on internet sources. As previously mentioned, we extracted a set of 12 indicators that measured the influence that digitalization had on the economies, that were divided into four dimensions, including globalization, rationality, professionalism, and the adoption of morality. The selection of the indicators for the global RPM analysis is a critical component of our research methodology. To ensure transparency and a robust justification for these choices, we provide the following rationale for selecting these specific indicators for each dimension: globalization, rationality, professionalism, and morality.

For the globalization dimension, to assess a nation's degree of globalization in digitalization, the following indicators were selected: global connectivity, high-technology exports, and research and development. These indicators measure the extent to which the countries are connected to the global digital network, as well as the extent to which they participate in the global digital trade and invest in digital innovation.

Regarding the rationality dimension, rationality in the digital era is a fundamental aspect of efficient economic decision-making [46]. The indicator of e-government development assesses the accessibility and efficiency of government services. The presence of online creativity indicates the implementation of digital tools and creative thinking of a country, while professionals in knowledge-intensive roles, such as data analysts, researchers, and

digital strategists, play a crucial role in gathering and interpreting data to support rational policy and business decisions.

For the professionalism dimension, the indicators of open government data, online access to financial accounts, and digital skills are used to assess professionalism. These indicators assess the extent to which countries use digital technologies to promote their transparency and accountability, to facilitate their professional financial transactions and literacy, and to develop their digital competencies.

For the morality dimension, internet freedom, green and sustainable development, and control of corruption were chosen as indicators to measure morality in digitalization. These indicators assess the extent to which countries use digital technologies to protect their online rights and freedoms, support their environmental and social goals, and combat their corruption and fraud in the digital age by promoting transparency, accountability, and anti-corruption technologies.

These indicators collectively provide a holistic view of each dimension, allowing us to evaluate the influence of digitalization on economies comprehensively. Taking into account that different research areas can prioritize unique indicators or methodologies, future studies are encouraged to explore variations and modifications to the approach of this study [47–49]. This transparent justification offers a clearer understanding of the indicator selection and its relevance to the research objectives.

Because the digital economy is essentially a fusion of the analog economy and digital technologies, it is influenced by a wide range of elements. At the same time, each dimension summarizes the information of several individual indicators (from 1 to 100). Each indicator has equal weight in the calculation of the final point. The time coverage of the study for the last updates is from 2019 to 2023 based on data availability. Therefore, this was the period that we considered for our analysis, which is presented in Table 2. The indicators utilized for measuring digitization and competitiveness rely on the data collected in the previous year. For example, the indicators for the year 2022 are based on information from the year 2021 and are identifiable in the sources used in the year 2022. The analysis used data from the most recent year for each indicator due to difficulty in finding data for the same year. In order to facilitate the understanding of our interpretations, we have kept the same notation. The descriptions of the indicators adopted for evaluation that characterize the processes for the digitalization level of the countries are presented in Table 2.

The DIANA economy framework focuses on categorizing countries into four types: digital, dinalog, anatal, and analog, based on various dimensions of digitalization. However, there are alternative frameworks and opposing views when it comes to assessing digitalization, such as the IMD world digital competitiveness ranking, which specifically evaluates a country's competitiveness in the digital age [62]. They consider factors like technology infrastructure, digital skills, and the adaptability of businesses to digital transformation. On the other hand, the ranking primarily focuses on business-related aspects of digital competitiveness. It may not fully capture social or government aspects of digitalization or digital inclusion. Moreover, the United Nations' EGDI measures the readiness and capacity of national governments to use digital technologies and the internet to deliver public services [42]. It focuses primarily on the digitalization of government services and does not encompass broader economic or societal aspects.

Another alternative framework is the digital economy and society Index (DESI), which was developed by the European Commission to measure the progress of EU member states towards a digital economy and society [63]. The DESI uses five main dimensions: connectivity, human capital, use of internet services, integration of digital technology, and digital public services. However, the index does not cover all aspects of the digital economy and society, such as the quality, security, or impact of digital services, or the social and environmental dimensions of digitalization. Therefore, DESI may not reflect the full potential and challenges of digital transformation for a country.

**Table 2.** Descriptions and sources of the indicators used in this study.

Indicator	Description	Year
Global connectivity	Global connectivity index (GCI): GCI ranks countries along an S-curve graph based on the pillars (supply, demand, experience and potential) and horizontally in connection with each of core technologies (broadband, cloud, IoT and AI) [50]	2020
E-government development	E-government survey: The report ranks countries based on the e-government development index (EGDI), which measures the readiness and quality of online services, telecommunication infrastructure, and human resources [51]	2022
Open government data	Global open data index: The index ranks countries based on the availability and accessibility of data in thirteen key categories, including government spending, election results, procurement, and pollution levels [52]	2019
Internet freedom	Internet freedom scores: The scores are numerical ratings that measure the level of internet freedom in different countries based on three categories: obstacles to access, limits on content, and violations of user rights ranging from 0 (least free) to 100 (most free) [53]	2022
High-technology exports	High-technology exports (% of manufactured exports): The economic indicator is used to assess a country's level of technological sophistication and its ability to produce and export high-tech goods in the global high-tech market and its potential for innovation and economic growth [54]	2021
Online creativity	Online creativity indicator of global innovation index: The indicator measures the online presence and impact of a country's creative outputs, such as cultural and creative services exports, video uploads, Wikipedia edits, and generic top-level domains [55]	2020
Online access to financial account	Online access to financial account indicator of global cybersecurity index: The indicator is a comprehensive dataset, which measures how people in selected economies access and use financial services using the internet to access an account at a financial institution or through a mobile money service provider [56]	2020
Green and sustainable development	Green economic outlook index: The index is a ranking of countries and territories based on their commitment and progress toward a low-carbon future. Investing in renewable energies, innovation, and green finance is an indication of how their economies are shifting toward clean energy, industry, agriculture, and society [57]	2021
Research and development	Research and development indicator of global innovation index: The indicator is one of the five components of the innovation input sub-index in the global innovation index (GII). It measures the level of investment and effort in creating new knowledge and technologies, which are essential for innovation [58]	2020
Knowledge-intensive employment	Knowledge-intensive employment indicator of the network readiness index: The indicator measures the share of employment in knowledge-intensive activities, such as high-tech manufacturing, information and communication, financial and insurance, professional and technical services, and education and health [59]	2022
Digital skills	Digital skills gap index: The index measures and ranks the digital skill levels of economies and territories based on six pillars: digital skills demand, digital skills supply, digital skills mismatch, digital skills focus, digital skills inclusion, and digital skills resilience [60].	2021
Control of corruption	Corruption perceptions index: The index is a global ranking of countries based on their perceived levels of public sector corruption. The report identified that corruption and conflict fuel each other, undermining peace and security around the world [61].	2022

Regarding the theoretical framework of the study, the DIANA economy differs from the other tools due to its focus on adaptation, dynamic and real-time data, holistic assess-

ment, customization, policy recommendations, emphasis on resilience, inclusivity, global relevance, and evolving metrics. It serves as a forward-looking tool to guide countries in their efforts to navigate and thrive in the digital age. Additionally, most of indexes related to digital transformation demonstrate that countries with a higher level of digitalization tend to have more developed economies and digital products, and technologies are vitally essential tools for modernizing and advancing countries. However, there is no doubt that digital products offer many advantages, such as convenience, accessibility, and reusability [52,56], yet they generally lack the tangible and emotional qualities that make analog items so valuable to collectors and consumers. In fact, analog products can often be more valuable than digital products, especially when it comes to luxury items or handcrafted goods [53]. Most developed countries today have embraced digital technologies to a significant extent because of the advantages they offer in terms of efficiency, innovation, and competitiveness. However, the specific mix of factors contributing to a country's economic development can vary widely, and digitalization is one of many potential drivers [20]. Therefore, there are some possible scenarios in which analog countries might have more developed economies because of natural resource wealth, competitive specialized industries with a relatively low reliance on digital technologies, strategic geopolitical positioning, or unique economic policies [54]. The DIANA economy is unique compared to other frameworks due to its concept that digital and analog economies are equal in importance and not superior to each other. It analyzes a country profile based on digital and analog environments that can help to identify weak points, and it offers digitalization and analogization strategies for analog and digital economies to be more competitive in today's age.

With the improvement in a country's economy, the question of how to drive the further development of digital and analog economy has aroused the thinking of policy makers. In order to maintain high levels of productivity and achievement, each economy struggles with digitalization and analogization. This paper studies the factors spurring the digital and analog economy in world counties based on a sample of selected countries and their data availability. Using the DIANA economy methodology, multivariate indicators have been developed to measure both the digital and analog economies. Additionally, we provide information about each country's economy as well as the steps that need to be taken in order to improve and enhance their position within the context of digitalization and analogization by conducting an in-depth comparative analysis.

### 3.2. Results and Discussion

This study analyzes and ranks the changes that countries around the globe have seen in their digital competitiveness to present the theoretical and practical fundamentals of analog and digital economies, refining their definitions. An analog economy, or a digital economy, is one part of a mixed economy that was first introduced in this study. As defined by the DIANA economy, digital economies are comprised of 90 percent digital and 10 percent analog, while analog economies comprise 90 percent analog and 10 percent digital. Moreover, dinalog economies can have a large share of digital at 70 percent and a smaller share of analog at 30 percent, and anatal economies can have 70 percent analog and 30 percent digital. However, in the previous section, it was stated that the percentage scores of dividing countries into the DIANA economy's the four concepts (digital, dinalog, anatal, and analog) are not static, and different fields of research may use their own methodologies and weightings based on their specific goals and objectives to adapt their assessments. Therefore, when using or interpreting a digitalization index, it is essential to understand the methodology and factors used and be aware of any changes or updates that may occur over time.

According to this study's criteria, data availability, quality, and comparability, as well as its methodological consistency, transparency, and interpretation and communication of its results calculating the scores and rankings of the selected countries, the initial percentage scores used to divide the four concepts of the DIANA economy have been modified in order to increase the study's applicability, relevance, and effectiveness. In the analysis

of the countries, 12 indicators of the DIANA economy pertained to every global RPM dimension (globalization, rationality, professionalism, and morality), including scores ranging from a minimum of 1 point to a maximum of 100 points. In our assessment, a country was categorized as a “digital country” when it attained a score of 75 points or higher. A “dinalog country” is identified when a country achieves a score within the range of 60 to 75 points. An “anatal country” classification is assigned to a country which scores between 30 and 60 points. Lastly, an “analog country” classification is solely applicable to countries that score below the threshold of 30 points. The choice of specific percentage thresholds for categorizing countries into “digital”, “dinalog”, “anatal”, and “analog” classifications is based on a combination of factors that aim to provide meaningful distinctions while remaining practical and broadly applicable. Furthermore, the thresholds are designed to facilitate cross-country comparisons and benchmarking by allowing researchers, policymakers, and businesses to understand where countries stand in their digital development journey, making comparisons and assessments more manageable. While the chosen thresholds serve as a starting point, they can be adjusted or refined based on specific research objectives, regional variations, or evolving global standards. This flexibility ensures that the classification system can adapt to changing contexts and criteria.

Table 3 shows the level of digitalization of countries which have populations of 40 million citizens or more based on seven dimensions: government (GOV), industry (IND), human capital (HUM), globalization (G), rationality (R), professionalism (P), and morality (M). As stated above, each dimension is scored from 1 to 100, and the total score is the average of the global RPM dimensions or government, industry, and human capital dimensions. Accordingly, the classifications of the countries into the four categories of the DIANA economy are shown based on their total score: digital, dinalog, anatal, and analog.

According to the table, the results show that among the 20 countries with large populations (40 million citizens or more), only two countries were classified as digital: the United States and the United Kingdom, with 76.0 and 75.2 points, respectively. These countries had high scores in all dimensions, especially in government, industry, people, and globalization. They are considered to have successfully adopted and explored new digital technologies across different sectors of the economy. The U.S. government was rated as the most digitalized government among the large population countries, scoring 85.0 out of 100, while its industry is the least digitized in comparison to the government and human capital dimension of the country. In fact, the U.S. government has actively pursued e-government initiatives and open data policies, aiming to improve the delivery of government information and services to citizens and businesses through digital channels, online portals, applications, and platforms. Although it seems that the U.S. industry lacks a digitalization process because of its highly diverse economy, encompassing industries ranging from traditional manufacturing like steel and textiles to high-tech sectors such as aerospace and electronics, it can embrace a more digitalized approach to remain competitive in the global market by leveraging its potential in globalization and professionalism factors, which are ranked as the highest scoring factors with 78.3 and 78.8 points. Additionally, the UK scored 76.6 out of 100 in the morality dimension, ranking first among the 20 countries. As this dimension measures the ethical and social standards for digitalization, such as internet freedom, green and sustainable development, and control of corruption, the country prioritizes promoting and adhering to ethical principles when developing and using technology, which can include considerations such as the responsible use of artificial intelligence, ethical guidelines for algorithmic decision-making, and avoiding technologies that may have harmful consequences.

The next category is dinalog, which includes three countries: Germany, Korea, and France. These countries have relatively high scores in most dimensions, but they are lagging behind in industry and globalization. The results suggest that Germany, Korea, and France are on a path towards digitalization, with significant strengths but also specific areas that require further attention and development to reach a higher level of digital economy. They

are considered to have potential to become digital leaders by improving their industrial competitiveness and global integration to digitalization.

**Table 3.** Analysis of countries with large populations (40 million citizens or more) based on the DIANA economy (2023).

Countries	GOV	IND	HUM	G	R	P	M	Total	Results
United States	85.0	63.4	79.6	78.3	74.8	78.8	72.0	76.0	Digital
United Kingdom	82.6	66.2	76.7	71.1	75.7	77.4	76.6	75.2	Digital
Germany	72.7	48.5	74.0	53.4	67.9	66.1	72.8	65.1	Dinalog
Korea, Rep.	70.8	45.2	70.0	64.6	56.8	67.5	59.0	62.0	Dinalog
France	74.3	44.3	64.6	53.8	63.5	56.8	70.2	61.1	Dinalog
Japan	72.0	31.6	62.0	57.1	46.7	47.9	69.1	55.2	Anatal
Spain	67.1	30.5	55.4	39.5	54.2	50.1	60.2	51.0	Anatal
Italy	68.4	27.0	53.2	39.0	51.3	44.9	62.9	49.5	Anatal
China	72.7	48.5	74.0	54.2	44.1	46.9	27.8	43.2	Anatal
Russian Federation	46.2	27.1	49.3	32.7	54.4	46.9	29.5	40.9	Anatal
Brazil	63.0	20.0	37.1	30.3	41.0	40.0	48.9	40.0	Anatal
Mexico	59.2	21.2	32.6	31.0	35.7	38.1	45.8	37.6	Anatal
Turkiye	48.7	20.3	36.7	26.4	41.3	41.8	31.4	35.2	Anatal
Thailand	50.2	21.9	29.9	29.3	33.5	35.5	37.7	34.0	Anatal
India	50.5	9.6	38.6	29.2	28.9	37.0	36.5	32.9	Anatal
Argentina	50.5	13.5	25.2	22.4	34.4	28.0	34.0	29.7	Analog
Indonesia	47.4	13.1	28.4	19.8	29.3	32.3	37.1	29.6	Analog
Nigeria	34.6	13.7	29.9	11.3	34.8	21.6	36.4	26.0	Analog
Egypt	36.0	10.7	31.3	16.7	33.2	23.1	30.8	26.0	Analog
Bangladesh	39.8	9.7	18.3	11.6	22.3	26.0	30.4	22.6	Analog

The largest category is anatal, which includes 10 countries: Japan, Spain, Italy, China, Russia, Brazil, Mexico, Turkey, Thailand, and India. These countries had relatively low scores in most dimensions, especially in industry and morality. As a result, they are also seen as having challenges to overcome in terms of digital transformation and innovation. Accordingly, managing digitalization initiatives in countries with large populations can be particularly complicated due to the scale and complexity of their diverse demographics, geography, and socioeconomic conditions [55]. It is essential for countries to improve their industrial productivity, quality, and morality concepts in order to embrace digitalization in an effective manner.

The last category is analog, which includes five countries: Argentina, Indonesia, Nigeria, Egypt, and Bangladesh. These countries have very low scores in all dimensions. They are considered to have a lack of digital readiness and capability. All of the countries also face shortages in human capital and skills, as well as difficulties in creating an enabling environment for digitalization through effective government policies and regulations. To overcome these challenges, they may need to invest more in their digital infrastructure for industry and education, government policies, and regulations, as well as fostering a digital culture and mind-set among their human capital [56,64].

On the one hand, the data for the countries with large populations shows that the digital economy is rapidly expanding throughout government sectors. On the other hand, the findings reveal that industry and human capital are the most critical factors in accelerating the development of the digital economy. At the same time, they perform different

actions in different areas. Therefore, it is crucial for the governments of these countries to enhance their levels of human capital and technology innovation to address the deficit in the digital economy. It is also possible that the anatal countries will benefit from learning from the best practices and experiences of other countries that have achieved higher levels of digitalization in their region or globally. In the analog countries, the governments may boost the digital economy by encouraging globalization and professionalism factors to work in digital transformation.

It is important for policymakers and researchers to tailor policy recommendations according to the unique strengths and challenges of each country based on their digitalization levels. The following are some possible policy recommendations for each category of country:

- For digital countries, such as the United States and the United Kingdom, the policy recommendations are to maintain their digital leadership and competitiveness, to foster digital innovation and entrepreneurship, to address the digital divide and inequality, and to balance the benefits and challenges of digitalization. It is also recommended for these countries to develop analogization strategies to be more competitive in the global market. For example, they could invest more in research and development, integrate digital and analog systems, support start-ups and small businesses, promote digital literacy and inclusion, and protect online rights and privacy.
- For dinalog countries, such as Germany, Korea, and France, the policy recommendations are to improve their industrial competitiveness and global integration to digitalization, to enhance their digital skills and creativity, to strengthen their digital governance and transparency, and to incorporate analog elements into their digital business models or strategies [12,65]. In particular, the government can develop their manufacturing and service sectors, develop online creative industries, open government data and services, and leverage the strengths of both digital and analog approaches.
- For anatal countries, such as Japan, Spain, Italy, China, Russia, Brazil, Mexico, Turkey, Thailand, and India, in order to embrace digitalization in an effective manner, the policy recommendations can include improving industrial productivity, quality, and morality, increasing their investment and innovation in digital infrastructure and technologies, developing their human capital and skills, and creating an environment that facilitates digitalization through effective government policies and regulations. A few examples include adopting best practices and standards for their industries, enhancing their education and training systems, and implementing supportive institutional and legal frameworks.
- For analog countries, such as Argentina, Indonesia, Nigeria, Egypt, and Bangladesh, the policy recommendations are to invest more in their digital infrastructure for industry, education, government policies, and regulations, as well as to foster a digital culture and mindset among their human capital. They also need to address their basic development needs and challenges that hinder their digital readiness and capability. Accordingly, they could improve their digital supply and internet connectivity, promote online learning and access to information, reform their bureaucratic and corrupt systems, and raise awareness and interest in digital opportunities.

Table 4 shows an analysis of 20 countries with mid-sized populations (between 15 million and 40 million citizens) based on the DIANA economy and global RPM dimensions. The categories are as follows: digital, dinalog, anatal, and analog. The table shows that only one country out of the 20 was categorized as digital, which is The Netherlands. This country has high scores in all dimensions, especially in government, people, rationality, and professionalism. Two countries are categorized as dinalog: Canada and Australia. They have moderate scores in most dimensions, but lower scores in industry and globalization. Six countries are categorized as anatal: Poland, Malaysia, Romania, Chile, Saudi Arabia, and Kazakhstan. They have low scores in most dimensions, especially in industry and people. Eleven countries are categorized as analog: Ecuador, Uzbekistan, Ghana, Morocco,

Peru, Cameroon, Sri Lanka, Guatemala, Nepal, Angola, and Cote d'Ivoire. Based on the results, most of the countries with mid-sized populations were considered as analog countries, which had very low scores across all the dimensions. In fact, as an analog economy typically refers to an economic system that primarily relies on traditional, non-digital methods and processes for conducting business and economic activities, the selected analog countries are likely labor-intensive and often lack automation or computerized systems. These countries may need to adopt more tailored and inclusive strategies that address their specific needs and opportunities in the digital era [12,66]. The results suggest that there is a wide variation in the levels of digitalization and analogization among countries with mid-sized populations. Some countries have achieved high levels of digitalization by investing in their infrastructure, human capital, government policies, and social acceptance [67,68]. Others have lagged behind due to various challenges such as a lack of resources, skills, or innovation.

**Table 4.** Analysis of countries with mid-sized populations (between 15 million and 40 million citizens) based on the DIANA economy (2023).

Countries	GOV	IND	HUM	G	R	P	M	Total	Results
The Netherlands	81.7	64.2	79.5	64.8	78.7	86.0	71.1	75.1	Digital
Canada	77.8	58.9	73.9	60.2	71.1	75.2	74.3	70.2	Dinalog
Australia	80.3	52.6	71.5	59.9	69.5	76.5	66.6	68.1	Dinalog
Poland	59.3	38.7	52.9	35.6	54.8	55.8	55.1	50.3	Anatal
Malaysia	52.6	35.4	47.0	43.9	41.4	45.5	49.3	45.0	Anatal
Romania	61.8	29.4	36.7	25.1	41.9	46.2	57.4	42.6	Anatal
Chile	51.9	27.6	39.6	27.2	45.9	41.5	44.3	39.7	Anatal
Saudi Arabia	44.3	20.8	48.7	31.4	42.6	39.7	38.2	38.0	Anatal
Kazakhstan	28.7	30.0	40.4	31.0	19.9	42.1	39.1	33.0	Anatal
Ecuador	50.7	14.0	23.8	15.6	28.9	26.9	46.6	29.5	Analog
Uzbekistan	42.9	21.2	23.9	14.2	30.2	42.7	30.2	29.3	Analog
Ghana	44.1	17.4	23.5	10.4	23.5	31.8	47.7	28.3	Analog
Morocco	43.5	15.4	22.2	14.8	22.9	23.5	46.9	27.0	Analog
Peru	40.3	13.4	26.1	15.0	31.5	28.0	31.9	26.6	Analog
Cameroon	36.7	19.4	18.5	15.4	19.8	27.7	36.6	24.9	Analog
Sri Lanka	22.4	10.2	30.3	9.2	13.1	24.6	37.0	21.0	Analog
Guatemala	33.0	12.7	17.4	12.0	21.4	22.9	27.9	21.0	Analog
Nepal	34.5	9.5	19.0	12.4	24.0	20.1	27.5	21.0	Analog
Angola	21.7	21.8	17.3	14.0	17.4	15.2	34.5	20.3	Analog
Cote d'Ivoire	26.2	15.2	17.0	9.7	20.9	21.0	26.3	19.5	Analog

As most countries with mid-sized populations are categorized as analog countries, an analog economy can have some advantages, such as preserving traditional values, cultures, and practices, as well as being less vulnerable to cyberattacks or digital espionage. However, an analog economy can also face many challenges in the modern world, such as lower efficiency, productivity, innovation, and competitiveness, as well as higher costs, risks, and environmental impacts [69]. It is important to note that while some regions or sectors of the global economy can still exhibit the characteristics of an analog economy, the trend in recent years has been toward increasing digitalization and the adoption of digital technologies across various industries and economies worldwide. In accordance with the

DIANA economy classification, the following policy recommendations can be tailored to each country category:

- For digital countries (The Netherlands), the The Netherlands is leading the digitalization efforts. To maintain and strengthen this position, the government should continue supporting applied research and the fourth industrial revolution, especially in emerging and frontier technologies, such as artificial intelligence, blockchain, cloud computing, big data, and the Internet of Things. It is also essential that digital countries can benefit from analogization strategies by incorporating analog elements into a predominantly digital economy to enhance their compatibility, flexibility, and customer experiences.
- For dinalog countries (Canada and Australia), Canada and Australia are making good progress, but they face challenges in industry and globalization. These countries should prioritize industry modernization and the adoption of digital technologies. They must enhance global integration, foster trade relationships, and promote international collaborations to facilitate digital globalization.
- The anatal countries (e.g., Poland, Malaysia, Romania, etc.) face significant challenges, especially in the industry and people dimensions. To enhance digital readiness, these countries should promote digital industrial transformation, supporting industries in transitioning to digital processes and automation for improved productivity. Additionally, it is recommended to address issues related to corruption and governance to build trust and attract investments to enhance digital skill development and digital literacy through training and education.
- The analog countries (e.g., Ecuador, Uzbekistan, Ghana, etc.) are in the early stages of digital transformation. They need to invest in building essential digital infrastructure, such as high-speed internet access and data centers. It can be essential to focus on human capital investment by streamlining regulatory processes and stimulating a digital mindset among the population to embrace digital opportunities and innovations, close the skills gap, and prepare the workforce for the digital era.

Table 5 presents an analysis of the countries with small populations, defined as 15 million citizens or less, based on the 12 indicators of the DIANA economy. The analysis shows that six countries out of the twenty are categorized as digital: Denmark, Singapore, Sweden, Switzerland, Norway, and Finland, while there are five countries classified as dinalog: New Zealand, Hong Kong (China), Austria, Belgium, and Ireland. In comparison with countries with large or mid-sized populations, countries with small populations appear to be more digitally advanced. It is likely that there are more opportunities and incentives for digitalization for countries with small populations due to their higher degree of openness and integration with the global economy [70,71]. Additionally, some countries with small populations are endowed with a higher level of income and education, which can enable them to invest more in their digital infrastructure, human capital, government policies, and social acceptance in comparison to countries with large populations. Therefore, they are likely to have a higher level of digital literacy and demand, as well as to be able to afford and access more digital goods and services. Furthermore, six countries are categorized as anatal: Czechia, Portugal, Hungary, United Arab Emirates, Slovak Republic, and Greece. Only three countries are categorized as analog: Qatar, Kuwait, and Cuba. Considering the results shown in Table 5, it appears that the countries that rely primarily on natural resources, such as agriculture, mining, or oil production, tend to be less digitalized. Accordingly, natural resource-dependent countries often derive a significant portion of their income from resource exports [72]. This economic dependence can lead to a focus on traditional industries, with less emphasis on diversification into digital sectors. When natural resources provide substantial revenue, there may be less incentive for governments and businesses to invest in digitalization. There is a possibility that they prioritize resource extraction and export over digital transformation.

**Table 5.** Analysis of countries with small populations (15 million citizens or less) based on the DIANA economy (2023).

Countries	GOV	IND	HUM	G	R	P	M	Total	Results
Denmark	85.5	70.6	81.2	68.7	77.9	86.4	83.5	79.1	Digital
Singapore	85.8	67.7	79.8	72.1	84.9	73.6	80.4	77.8	Digital
Sweden	84.5	65.2	79.3	68.6	80.7	78.4	77.8	76.3	Digital
Switzerland	84.6	62.3	80.2	71.1	82.5	71.7	77.3	75.7	Digital
Norway	82.7	63.9	79.0	63.4	73.1	85.0	79.3	75.2	Digital
Finland	82.8	65.2	77.0	63.9	75.1	81.3	79.7	75.0	Digital
New Zealand	83.8	59.3	65.6	55.3	68.5	76.2	78.1	69.6	Dinalog
Hong Kong, China	67.4	57.7	67.3	58.5	71.9	51.8	74.4	64.1	Dinalog
Austria	72.5	53.2	64.7	55.0	70.0	58.3	70.6	63.5	Dinalog
Belgium	68.2	45.4	69.4	49.8	63.7	60.4	70.1	61.0	Dinalog
Ireland	69.2	44.6	67.1	51.0	65.3	54.0	70.8	60.3	Dinalog
Czechia	71.7	44.4	49.5	40.2	58.1	60.9	61.7	55.2	Anatal
Portugal	62.9	29.1	57.8	35.8	58.4	43.9	61.7	49.9	Anatal
Hungary	62.6	31.5	47.7	35.7	52.4	50.6	50.4	47.3	Anatal
United Arab Emirates	49.0	30.5	55.1	37.4	54.3	41.1	46.9	44.9	Anatal
Slovak Republic	56.0	31.6	43.3	26.5	50.8	47.3	49.9	43.6	Anatal
Greece	56.6	22.6	41.9	25.9	48.5	36.8	50.4	40.4	Anatal
Qatar	39.3	9.6	40.0	16.7	35.1	30.8	36.0	29.7	Analog
Kuwait	40.5	19.2	28.7	17.2	36.9	29.0	34.7	29.4	Analog
Cuba	28.1	10.8	25.3	10.4	21.8	23.4	30.1	21.4	Analog

In accordance with the results, most of the countries with small populations are classified as digital and dinalog, indicating that their economies are highly digitized. However, digitalization can also pose some risks and barriers for developing countries. Accordingly, it is important to note that digital countries can be highly volatile due to the fast-paced nature of the technology industry [72]. Investors should conduct thorough research and consider both the opportunities and risks associated with investing in digitalized economies. Additionally, market conditions and industry-specific factors can change rapidly, impacting share prices accordingly. Investors may replace certain sectors or industries with others based on changing economic conditions. Economic factors such as inflation, interest rates, and overall market conditions can influence share prices. If the broader economy is struggling or facing uncertainty, it can lead to a decline in digital industry shares. Furthermore, political tensions, trade disputes, or geopolitical events can affect the digital economies with international operations, including digital industries. In this case, analogization strategies are important for digital countries because they can help them to balance the benefits and challenges of digitalization and to leverage the strengths of both digital and analog systems. Incorporating analog elements into digital business models or strategies allows systems to provide a more personalized and human touch to customers or stakeholders. Analogization is not a rejection or replacement of digitalization, but rather a complement and enhancement of it. By finding the optimal mix of digital and analog systems for different contexts and purposes, digital countries can achieve a more inclusive and sustainable development. The following recommendations are for the digital countries (e.g., Denmark, Singapore, Sweden, etc.), as part of their analogization strategies:

- Opening physical stores or showrooms to complement online sales and provide a more tangible experience to customers.

- Integrating digital technologies in traditional analog industries such as agriculture or manufacturing to increase efficiency and productivity while maintaining the human touch and experience.
- Hosting hybrid events that combine physical attendance with digital streaming or participation options.
- Combining digital and analog systems to create hybrid solutions that can overcome the limitations or vulnerabilities of each mode.

In countries with small populations, digitalization can have an enormous impact on growth and development. The following are some strategies for digitalization that the analog and analog countries (e.g., Czechia, Qatar, Cuba, etc.) can consider:

- Developing a comprehensive national digitalization plan that outlines clear goals, strategies, and timelines. This plan should be aligned with the country's broader economic and social development objectives.
- Implementing e-government strategies to simplify administrative processes, reduce government regulations, improve public service delivery, and offer online portals for citizens to access government services conveniently.
- Expanding digital learning opportunities, including online education platforms and digital resources for schools and universities. This can help bridge educational gaps and improve access to quality education.
- Designing smart city projects that use technology to improve urban planning, transportation, energy efficiency, and overall quality of life in urban areas.
- Reducing regulations and promoting e-commerce to make it easier for local businesses to access global markets and expand their reach.
- Promoting sustainable and green technologies to reduce the country's environmental footprint while fostering innovation in renewable energy and eco-friendly practices.
- Establishing international partnerships and agreements with other countries, organizations, and corporations to access expertise, resources, and global markets.

In our study, we also conducted a correlation analysis to examine the relationship between the dimensions of global RPM. A correlation analysis is considered as a useful instrument for exploring our data and understanding the characteristics of relationships. Presenting a correlation matrix can significantly enhance the comprehensibility of research results, assisting readers in gaining insight into more detailed analyses. A correlation coefficient, on the other hand, offers a quantitative assessment of both the magnitude and direction of the linear connection between two variables. The correlation coefficient spans from  $-1$  to  $1$ , with  $-1$  denoting a complete negative correlation,  $0$  signifying no correlation, and  $1$  indicating a complete positive correlation. Table 6 shows that this correlation matrix indicates that there are positive relationships between the dimensions of globalization, rationality, professionalism, and morality in the context of digitalization in countries. As evidence, the correlation between globalization and rationality showed the most significant coefficient of  $0.7167$ . This suggests that as a country scores higher in terms of globalization, it also tends to score higher in rationality. In other words, the positive correlation implies that as a country engages more with the global digital economy, it is more likely to make decisions related to digitalization in a more rational and methodical manner. Policymakers and researchers can use these findings for countries aiming to enhance their digital economies to focus on rational decision-making processes and strategies as they engage more with the global digital landscape. The correlation coefficient of  $0.5432$  between globalization and professionalism in the context of digitalization suggests a positive but moderate association between these two dimensions. This means that as a country's level of globalization increases, its level of professionalism in digitalization tends to increase as well, though the relationship is not as strong as in the case of globalization and rationality. There is higher positive correlation between the globalization and morality dimensions, with a correlation coefficient of  $0.6212$ . By exploring the connections between globalization and morality in digitalization, it is possible to gain a more comprehensive understanding of the opportunities and challenges that digitalization brings to our society

and environment. There is also the possibility of developing more ethical frameworks and strategies to shape the digital future in a way that respects human dignity and promotes sustainable development.

**Table 6.** Correlation coefficients of independent indicators.

	Globalization	Rationality	Professionalism	Morality
Globalization	1.0000			
Rationality	0.7409	1.0000		
Professionalism	0.5432	0.4423	1.0000	
Morality	0.6212	0.5292	0.5983	1.0000

The correlation between rationality and professionalism resulted in the lowest coefficient, standing at 0.4423. While the correlation was positive, it was weaker than the other correlations observed in the analysis. This could lead to discussions on how to strengthen the relationship between rationality and professionalism in the context of digitalization. The correlation of morality with rationality and professionalism showed positive results, with coefficients of 0.5292 and 0.5983, respectively. In both cases, the correlations between the dimensions were close to each other, with a small difference. These insights can be valuable for understanding how these dimensions interact and influence the digitalization efforts of countries.

In conclusion, the analysis shows that most of the countries, 41 out of 60, are analog and anatal, which means that these countries depend on an analog economy. Therefore, there is a need to form digitalization strategies for converting from analog to digital. By exploring the current situation of the main industries using the DIANA economy, this analysis can be useful to form strategies and policy recommendations to develop a country's economy in the long-term and short-term. Some of the issues discovered here will require urgent attention, and neglecting them could lead to serious problems in economic and social processes of the country in the long-term. These are the analyses of main industries that hold them back from achieving their full potential, restricting growth in the process and giving an edge to their competition. For instance, a lack of a digital economy is often a weakness for most industries.

#### 4. Conclusions

The main objectives of this research was to conduct a DIANA economy and global RPM analysis and to examine the various definitions and concepts of measuring digital and analog economies using a comprehensive approach. Furthermore, this study analyzed and ranked the changes that countries around the globe have seen in their digital competitiveness, presenting the foundations of analog and digital economies and refining their definitions. As the DIANA economy investigates the concepts of digital, dinalog, anatal, and analog environments, the governments can develop appropriate strategies to meet their unique needs and challenges by identifying their position within this framework. In the meantime, the global RPM analysis enables countries to formulate strategies that emphasize globalization methods, rational economic decision-making, professionalism, and moral considerations by comprehensively evaluating the four dimensions.

Furthermore, this paper has classified the countries into three groups according to their population size: large, mid-sized, and small. There are a number of important findings and implications presented in this research. In this regard, countries with large populations tend to have low levels of digitalization and were mostly classified as anatal countries. These countries need to improve their policies and practices based on globalization and professionalism factors to develop digital transformations. Additionally, countries with mid-sized populations possess the lowest level of digitalization and are mostly classified as analog countries. It is possible for these countries to boost their digital economies by

enhancing their rationality and professionalism factors and by adopting growth strategy-oriented governments, industries, or human resource development. Lastly, countries with small populations generally experience high levels of digitalization and are considered mostly as digital or digital countries. While digital economies offer numerous advantages in terms of efficiency, speed, and convenience, analogization strategies are important for digital countries for balancing the benefits and challenges of digitalization and to leverage the strengths of both digital and analog systems by incorporating analog elements into their digital business models or strategies. Furthermore, the analysis revealed that the majority of the countries were classified as analog and analog, which implies that they rely on analog economies and need to develop digitalization strategies to transition from analog to digital.

This research study offers several key contributions to the sustainable tourism literature. This research could benefit from a more detailed explanation of the DIANA economy and global RPM frameworks, as well as further explanation of the methodology and data sources used to measure and classify the countries. This would help the readers to understand the logic and validity of the analysis and results. Furthermore, the findings have implications for policymakers by offering guidelines for strategic decisions aimed at shaping the digital future of their countries. It emphasizes the importance of addressing specific factors, such as globalization, professionalism, and rationality, in designing effective digitalization strategies. Moreover, this study introduces the concept of analogization as a strategy for digital countries to balance the benefits and challenges of digitalization. This innovative approach suggests incorporating analog elements into digital business models to enhance compatibility, flexibility, and customer experiences by categorizing countries into three groups based on population size, providing appropriate recommendations for each group. In conclusion, this research contributes valuable insights into digital and analog economies, emphasizing the critical role of frameworks like the DIANA economy and global RPM in understanding and navigating the complexities of the digital age. By providing rankings, policy implications, and strategies tailored to different population categories, it offers a roadmap for countries and businesses seeking to thrive in an increasingly digitalized world.

While the digitalization indicators of the DIANA economy provide valuable insights and a relative ranking of countries in terms of their digital and analog progress, it should be noted that there are some limitations. They serve as useful tools for benchmarking and identifying areas for improvement, but they may not provide an exact or comprehensive assessment of a country's overall development or digital maturity due to several factors such as subjectivity in indicator selection, data availability and quality, and regional disparities. Moreover, different researchers or organizations may have varying interpretations and may assign different scores, potentially leading to inconsistencies. The lack of standardization in scoring and categorization could affect the comparability of results. Therefore, future research should consider using multiple sources of data for each indicator and should apply robustness checks and a sensitivity analysis to test the reliability and validity of the results. Secondly, the analysis relied primarily on quantitative data, potentially missing qualitative insights from different countries regarding digitalization. Furthermore, this quantitative approach may not deeply explore the characteristics and complexities of each country's digital landscape. Additionally, the research acknowledges data availability and comparability as criteria, but it does not elaborate on how these issues may have influenced the results or how data gaps were addressed. Qualitative analyses, such as case studies or stakeholder interviews, can offer a deeper understanding of the specific challenges and success stories within each country. Additional context and qualitative analyses for future study are necessary to validate, explain, or challenge the findings of the quantitative analysis, as well as to generate new questions and hypotheses of a country's digitalization status and issues.

A further limitation of this research study is the potential for data time lag. For example, the indicators from the year 2022 can be based on information from the year 2021 and are identifiable in the sources used for the year 2022. Using data from different time periods, with a time lag of a year or more between data collection and the analysis, can limit

the accuracy and timeliness of the findings. This time lag may not accurately reflect the current state of digitalization and competitiveness in the countries under study. It can also affect the ability to capture dynamic changes and developments in these areas, particularly in fast-moving fields like technology and digitalization. Future research should make efforts to improve the accuracy and comparability of the data and consider their impact on the relevance and applicability of the research to the present for cross-country analyses.

Lastly, this research does not account for the diversity and complexity of digital and analog economies within and across countries, which may limit the generalizability and applicability of the findings and recommendations. For example, it is possible that different regions, sectors, or groups within a country may have different levels of digitalization or analogization, or they may face different challenges or opportunities in their digital transformation. Moreover, it is possible that different countries may have different contexts, cultures, or preferences that influence their digitalization or analogization strategies, or they may require different solutions or approaches to address their specific needs or goals. A comparative analysis is needed for future research of the digital and analog economies across different regions, sectors, or groups within a country to identify the factors that influence their level of digitalization or analogization and the challenges or opportunities by exploring how their contexts, cultures, or preferences affect in their digital transformation. These limitations should be considered when interpreting this study's findings and recommendations, as they impact the overall reliability and generalizability of the research. Addressing these limitations in future research can lead to a more comprehensive understanding of digital competitiveness and its complexities.

In conclusion, our research underscores an important consideration of the DIANA economy and global RPM frameworks in the modern business landscape. These analytical tools provide a comprehensive understanding of the factors that contribute to success and failure, thereby guiding organizations towards informed decision-making and enhanced competitiveness. As businesses continue to evolve in the digital age, the insights offered by the DIANA economy and global RPM analyses serve as indispensable compasses, guiding them through the intricacies of an ever-changing economic and global environment. In an era where adaptability and strategic acumen are key, these frameworks offer a crucial advantage in achieving sustainable growth and resilience.

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