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The 'Bad Behavior Index': A Composite Measure of the Development Hindering Behavior of Individuals and Institutions

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Abstract: Composite indices have become a popular tool for providing a quantitative, simplified, and visualized representation of complex phenomena. An example of such is the Human Development Index (HDI) which ranks countries by their level of development. The primary limitation of the HDI is its narrow scope, which hinders its effectiveness at explaining why some nations are more developed than others. The discussion as to why some nations are more developed than others goes back as far as the 14th century, where Ibn Khaldun developed a theory which aims to explain why civilizations rise and fall. Some of the hypotheses which seek to answer this question point to the importance of economic freedoms, absence of corruption, high investment in human capital, and the importance of institutions etc. to development. One hypothesis which has not been properly studied regards the culpability of individual and institutional behavior. The purpose of this study is to introduce a composite measure of the development hindering behavior of individuals and institutions, i.e., the Bad Behavior Index (BBI). The methodology of this study is influenced by the Mazziotta & Pareto framework for composite indices. The index weights have been computed by integrating expert opinion with the Fuzzy Analytic Hierarchy Process (FAHP). The findings of this study suggest that African countries engage in the highest level of bad behavior, which subsequently leads to their poor socio-economic development, whereas Northern countries engage in the least level of bad behavior. The study also finds that the most important drivers for socio-economic development are low levels of corruption, high levels of knowledge creation, strict application of the rule of law, high levels of social cohesion, and high levels of political stability.

Keywords: composite index; behavior; development; institutions; fuzzy AHP; expert opinion.

JEL classification: B5; C4; D01; D02; O1.

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1. INTRODUCTION

Like economic models, composite indices provide a simplification of reality. They provide a simplified, quantitative, and visual representation of phenomena that are complex and multidimensional in nature. Many composite indices have been developed to measure a country's level of development. The most popular of which is the UNDP's Human Development Index (HDI) (2019). The HDI draws influence from Sen's (1985) capability approach in its multi-dimensional nature, sharing the same ideological belief that the quality of life of individuals should not be measured merely by economic variables, but also include measures which are considered necessary for the individual to lead a decent life. The HDI was developed by economist Ul Haq (1995), who developed the index with the goal of enlarging people's choice – i.e., expanding their capabilities and functioning's.

The HDI and the capability framework is not the only approach which measures well-being. In the 1970's the focus was on economic well-being as an absolute measure of the development of societies, i.e., Neo-liberal approach (Jolly, 2003; Anto, 2011). This approach was soon replaced by the basic needs approach which focused on measures other than income. This approach focused on what individuals need in terms of resources to achieve long-term physical wellbeing. An example of such is focusing on needs such as food, shelter, access to education, and so on and so forth. The main objective of this approach is to provide more resources and better opportunities to those who are marginalized. The sustainable development approach soon replaced the basic needs approach, which shifted focus to addressing the harmful effects of human activities on the environments ability to provide sustainable resources. The sustainable development approach was later replaced by the human capability approach which focused more on the capability, opportunities, or freedoms available to individuals, rather than the goods or resources available to them. As aforementioned, this approach serves the theoretical basis for the HDI. The HDI ranks countries according to their level of development, as determined by three measures: 1) GNI per capita, which represents the measure of 'decent standard of living'; 2) life expectancy, which represents the measure of 'long and health life'; 3) expected years of schooling and mean years of schooling; which represents the measure of 'access to education'. The HDI assigns equal weights to the three dimensions, and fixed minimums and maximums are then utilized to transform the data. The results of the HDI are based on the average of the normalized dimensions.

The HDI is not without its limitations, as there is an extensive body of literature on its shortcomings (Kelley, 1991; McGillivray, 1991; Murray, 1991; Dasgupta & Weale, 1992; Lind, 1992; Srinivasan, 1994; Sagar & Najam, 1998; Todaro & Smith, 2006; Chhibber & Laajaj, 2007; Klugman *et al.*, 2011), among others. The primary criticism of the HDI pertains to its narrow definition of development, many scholars arguing that it provides "an oversimplified view of human development by relying on only a few indicators often derived from data of low quality" (Srinivasan, 1994). In short, the HDI was born from the failures of previous measures of development, as outlined in the preceding section.

Despite the plethora of literature addressing its limitations, the HDI is still widely used today as a measure of development. The primary reason for that is because of data availability, a lack of an alternative framework which properly defines development, and a historical emphasis on economic well-being as the primary measure of the socio-economic development of countries.

The reliability of the HDI as a measure of socio-economic well-being is a subject of debate. In terms of alternatives, there are numerous quantitative measures of development, but the HDI is often favored due to its simplicity, which considers only three dimensions, and data availability (Luque *et al.*, 2016). However, the HDI's simplistic nature and narrow economic focus has led to criticisms that it does not provide an accurate measure of development (Streeten, 2000). Moreover, the high correlation of the HDI with its variables (Ghislandi *et al.*, 2019), i.e., GNI per capita, life expectancy, mean years of schooling, and expected years of schooling, take away from the credibility of the HDI.

In addition to its narrow scope and simplified representation of reality, the HDI has limited capacity to elucidate the nature of development disparities across nations. While various hypotheses, such as the 'Resource Curse Thesis' of Auty (1995), the 'Endogenous Growth Theory' of Romer (1994), and 'Inclusive Institutions' of Robinson and Acemoglu (2012), offer potential explanations for such disparities, the HDI does not effectively address this issue.

This study contends that, while the previously stated hypotheses and others may have merit, the focus on external factors often overshadows the role of internal elements in explaining development disparities across countries. The culpability of individual and institutional behavior, for instance, is frequently overlooked. This study aims to explore an alternative hypothesis that focuses on such internal factors. Specifically, rather than attributing underdevelopment to poverty, corruption, political instability, and the like, this study posits that some countries are less developed than others due to bad behavior at the individual and institutional levels, which can serve as precursors to the aforementioned problems. This hypothesis, which emphasizes the importance of internal elements, has not been adequately investigated. The lack of a theoretical framework that clearly defines and identifies development-hindering behavior, also known as bad behavior, at the individual and institutional levels contributes to the absence of a quantitative measure for analyzing the impact of such behavior on development.

With that said, how can one develop such a quantitative measure of the development hindering behavior of individuals and institutions? What theories could be utilized to serve as the anchor for such a measure? What is the methodology behind constructing such a measure? How can one test the reliability and validity of the composite index outcomes? And what behaviors or variables are most important for development? These are some of the questions this study seeks to answer.

As such, the purpose of this paper is to introduce a composite measure of the development hindering behavior of individuals and institutions hereby referred to as the ‘Bad Behavior Index’ (BBI). This measure aims to be a more holistic and accurate measure of socio-economic development relative to the HDI. The index is based on a synthesized theoretical framework which will be discussed in the upcoming text and is based on proxies which are supported by theory and literature as culprits for poor development.

2. THEORETICAL FRAMEWORK

According to Mazziotta and Pareto (2017), the first step in constructing a composite index is to define the problem being measured, anchored by a theoretical basis for measuring such a phenomenon. With that said, the problem being studied is regarding the impact of individual and institutional behavior on the socio-economic development of countries. Does

engaging in *good* behavior contribute to the rise of nations? And does engaging in *bad* behavior lead to the fall of nations? How can one categorize behavior as either good, i.e., development promoting, or bad, i.e., development hindering? Is there any theoretical justification for measuring the behavior of individuals and institutions? The upcoming text will address some of these concerns.

2.1 Measuring the behavior of individuals

There is a lack of a theoretical justification for quantifying the behavior of individuals and institutions within the context of development. Nevertheless, various scholars have touched upon the culpability of behavior on the development of societies. For example, commenting on the fall of Muslim civilizations of the past, Al-Attas (1978) addresses individual culpability and how "it is important to stress the individual in seeking a just solution to our problem rather than the society and the state". According to Chapra (2008), commenting on Ibn Khaldun's theory of development, "the viability of the dynasty depends on the viability of the political authority". According to Ibn Khaldun (2004) himself, political authority hinges on the behavior of man, as evidenced by "the good qualities in man are appropriate to political and royal authority, since goodness is appropriate to political authority", as well as "The dynasty is an authority through which life is given to proper behavior. Proper behavior is a policy directed by the ruler" (Ibn Khaldūn, 1967). Smith (1759) discusses in the 'Theory of Moral Sentiments' the importance of behavior for achieving happiness, well-being, and the perfection of the world. To achieve this purpose, individuals must behave in accordance with general rules and guidelines which are the commands and laws of God. Those who follow these rule and guidelines are deemed men of honor, whilst those who do not follow those rules are deemed worthless fellows. Al Ghazaly (1937) expands upon Al Juwainy's (Kamali, 1999) framework of Islamic jurisprudence, i.e., Maqasid of Shariah (MS), to focus on the well-being or Maslaha dimension by elaborating upon the necessary behavior individuals must abide by to achieve well-being. Engaging in such behavior leads one to achieve societal well-being, i.e., Maslaha, whilst disobedience leads to societal harm, i.e., Mafsada. Weber (1958) argues that the Protestant Ethic led to an economically prosperous Calvinist society in Northern Europe relative to the Catholic South. Weber's thesis although at first sight centers on how religion can either positively or negatively impact economic well-being of society, deep down it centers on how behavior can have a positive role on development, as the Calvinists engaged in development promoting behavior such as a high work ethic, economic efficiency, thrift, and unobtrusive accumulation of wealth.

Various scholars have touched upon the pivotal role behavior plays in the development of societies, but the current literature has barely scratched at the surface of the hypothesis that individual and institutional behavior are culpable for the poor development of some societies. The rationale behind this is that what is deemed development promoting or development hindering behavior could be subjective, i.e., what is considered good behavior in one society could be perceived as bad behavior by another. As such, the first step in development a theoretical framework which facilitates for quantifying the behavior of individuals and institutions is to identify from theory and literature what is considered development hindering behavior and to properly define it. Once this objective it achieved, only then can a robust and empirical test capable theoretical framework can be developed.

Such a framework can be developed by synthesizing some of the theories discussed earlier, particularly the concept of Mafsada in the Maqasid of Shariah (Al Ghazaly, 1937) and

Adam Smith's worthless fellow (Smith, 1759), both of which serve as proxies for the behavior which leads to societal harm, behavior which only a worthless fellow would engage in.

The decision to prioritize Mafsada over Maslaha, in the Maqasid of Shariah, and measuring bad behavior over good behavior is due to the key principle widely accepted among Islamic scholars which is pushing away harm is prioritized over achieving Maslaha; assuming both are equal. Moreover, the reason for focusing on Adam Smiths' worthless fellow over the man of honor is because Smith viewed the act of disobedience to the rules and guidelines set by God as an aggressive form of bad behavior which goes against the plan of the deity and leads to the unhappiness of mankind. This is evidenced by the following passage in TMS: "By acting other ways, on the contrary, we seem to obstruct in some measure, the scheme which the Author of nature has established for the happiness and perfection of the world, and to declare ourselves, if I may say so, in some measure the enemies of God" (TMS III.5.7: 166; as cited by Berry *et al.*, 2013).

In summary, the lack of a theoretical framework which facilitates for quantifying the development hindering behavior of individuals means that it is essential to develop a framework which can provide theoretical justification for measuring such behavior. Various authors have discussed the pivotal impact behavior has on development, but not as far as to develop a robust framework which facilitates for empirical testing. In addition, some authors such as Sen (1987) have also discussed the impact of ethics on development, calling for a re-engagement between the two fields (Qizilbash, 2008). The idea that behavior, good, bad, ethical or otherwise, can impact development has long been discussed by scholars. However, there is a lack of a robust framework to study the relationship between these variables and development which can be attributed to the lack of consensus on what constitutes good or bad behavior within and across disciplines. This disagreement may arise from divergent epistemic orientations and worldviews, such as the Platonist view that human nature inherently encompasses knowledge, and the Aristotelian view that emphasizes experiential knowledge over innate knowledge. This epistemological divide resulted in the secularization of knowledge and disenchantment of nature, as well as the emergence of schools of thought that rejected established ethical norms, leading to more subjective behavior and a departure from established ethical frameworks like divine command theory (Al Fozaie, 2022).

In conclusion, this study acknowledges the theoretical limitations of the current literature. This study seeks to utilize the concepts of Mafsada in the Maqasid of Shariah, i.e., societal harm, and Adam Smiths' worthless fellow to serve as a justification for measuring the development hindering behavior of individuals and institutions, with particular emphasis on the concepts of adherence to rules and guidelines which if individuals engage in, they can achieve societal well-being, whilst not abiding by them leads to societal harm, under the assumption of an aggregated effect. The theories utilized in this study will influence the proxy selection process, as the proxies included in the BBI will represent behavior which a worthless fellow would engage in, i.e., Adam Smith's theory in TMS, which subsequently leads to societal harm, i.e., the concept of Mafsada in MS.

2.2 Measuring the behaviour of institutions

From a linguistic perspective, the terms *organization* and *institution* are often used interchangeably. From a theoretical perspective however, there are distinctions. According to Khalil (1995), organizations refer to a group of individuals or agents acting towards a common

goal, whereas institutions refer to formal and informal social structures. Ménard (1995) however states that some economists use the two terms interchangeably, especially those from the pre-neo-institutionalism era, referring to organizations as institutions or institutional arrangements (Davis & North, 1971; Jensen & Meckling, 1976), as well as variants of market activities (Alchian & Demsetz, 1972).

Despite the considerable scholarship on the topic, a clear definition of what constitutes an institution remains elusive (Alvesson & Spicer, 2019). Indeed, as DiMaggio and Powell (1991) contend, it is often easier to identify what institutions are not, rather than what they are. This study adopts a broad definition of institutions, which includes formal and informal structures such as public institutions, economic and political systems, and religious and cultural groups.

Elaborating upon formal and informal institutions, formal institutions are those developed by the political authority. They are defined as "the humanly devised constraints that structure political, economic, and social interaction" (North, 1991); the government, the legal system, the education system, and the healthy system are all examples of formal institutions. On the other hand, informal institutions are unwritten and socially shared rules, i.e., culture and norms (North, 1990; Kaufmann *et al.*, 2018).

The various theories discussed earlier were referring to the behavior of individuals or members of informal institutions, so how can one measure the behavior of the formal institutions? According to Voigt (2013), the common practice is to measure the outcome of the policies of these institutions. An alternative approach is to conduct identical experiments in different countries (Voigt, 2018). The limitation of such approaches is their narrow focus on the product or outcome of these institutions policies, and not on whether these institutions are holistically development hindering or development promoting. To elaborate, a particular policy could in fact lead to an outcome which creates more jobs in the local economy, but it also could lead to greater income inequality. As such, measuring the effectiveness of these institutions policies is an inefficient measure of whether these institutions are development promoting or development hindering institutions. This study adopts an alternative measure which seeks to provide justification for measuring the behavior if institutions by arguing that formal institutions are but the agglomeration of the members of a country's informal institutions. As such, formal institutions can be measured by aggregating the behavior of the members of the informal institutions working within the formal institution, and the aggregated behavior of these members is what deems whether an institution is development hindering or development promoting. This of course requires the construction of a framework which defines and identifies what is the behavior that is considered development hindering or development promoting as well as developing a protocol for measuring such behavior. An example of such behavior includes but is not limited to worker productivity, bribery, embezzlement, environmental footprint, among others. It must be made clear that not all institutions are identical, meaning that different institutions could have different units of measurements or proxies for what is considered development hindering or development promoting behavior. The idea itself however, aggregating the behavior of the members of the informal institution to reflect the behavior of the formal institution can be generalized and replicated for a country's various institutions.

In summary, due to a lack of a theoretical justification for measuring the behavior of formal institutions, this study adopts an alternative approach which aggregates the behavior of an institutions members so that it reflects the behavior of the institution itself. This is a novel approach which needs to be examined further and elaborated upon. However, this

approach is essential for the construction of the index this study proposes, since it justifies the use of some of the proxies being utilized in composite index – i.e., the Anti-Money Laundry proxy does not only reflect the development hindering behavior of a country's constituents, but also the behavior of the countries various institutions who have failed their duty of care in preventing such behavior.

2.3 Theoretical Framework Summary

The study builds on the concepts of Mafsada (Al Ghazaly, 1937) and worthless fellow (Smith, 1759) to quantify the development hindering behavior of individuals and institutions. Various measures of bad behavior are aggregated into the BBI, which seeks to represent actions that an honorable person would not engage in, while a worthless fellow would. The study highlights the need for a theoretical framework that can provide justification for measuring the bad behavior of individuals and institutions. While many authors have discussed the impact of behavior on development, no robust framework has been developed for empirical testing. The study recognizes the inadequacies of the existing literature in measuring institutional behavior and suggests an alternative method of aggregation, whereby the actions of an institution's members are used as a proxy for the behavior of the institution as a whole. This approach aims to validate the selection of certain proxies that reflect the conduct of both individuals and institutions.

3. METHODOLOGY

3.1 Composite Indices Framework

According to literature, the most popular framework for developing composite indices is the OECD and Joint Research Centre-European Commission (2008) framework. There are various other authors who develop a framework for constructing indices, including but not limited to Barrera-Roldán and Saldívar-Valdés (2002); Krajnc and Glavič (2005); Mazziotta and Pareto (2012); Armin Razmjoo *et al.* (2019); Dolge *et al.* (2020). It must be noted that no universal method exists for constructing composite indices (Mazziotta & Pareto, 2017), as such, best practice is to adopt the framework which has been extensively utilized in literature, as well as identifying highly influential and well-versed authors of this particular method. In this regard, this research adopts the framework of Mazziotta and Pareto (2017) which itself is influenced by the OECD and Joint Research Centre-European Commission (2008) framework. The reason for adopting this framework is due to the expertise of the authors at developing composite indices, as they have published several papers on this topic in the past couple of years (De Muro *et al.*, 2011; Mazziotta & Pareto, 2012, 2013, 2014, 2016, 2017, 2022). This study adopts the Mazziotta and Pareto (2017) framework for constructing composite indices, and it can be summarized as follows:

1. Define the phenomenon to be measured.
2. Select a group of individual indicators.
3. Normalize the individual indicators.
4. Aggregate the normalized indicators.
5. Validate the composite index.

Expanding on the aforementioned, the *first step* is to define the concept being measured, and this includes defining the theoretical framework for the index, as according to the authors "the theoretical part is not separate from the statistical-methodological one" (Mazziotta & Pareto, 2017), which shows the great emphasis the authors place on the selection of a theoretical framework which best describes the purpose of the index.

The *second step* involves the selection of the various proxies of the index and their respective measures. The authors also emphasize the importance of this method, and how it should not be "independent from the choice of the aggregation method" (Mazziotta & Pareto, 2017).

The *third step* involves normalizing the selected indicators as, most likely, they will have different units of measure, as well as possibly having opposite impacts – i.e., GDP per capita and unemployment, for example, have opposite effects on the dependent variable. The most popular normalization methods according to the authors (Mazziotta & Pareto, 2017) are the 1) Standardization approach – i.e., "converting the indicators to a common scale of mean zero and standard deviation of one" (Mazziotta & Pareto, 2017); 2) Rescaling approach – i.e., a min-max approach which normalizes the indicators to a range of 0 to 1; 3) Ranking approach – i.e., ranking the countries, for example, based on their performance in this particular indicator; 4) Indicization approach – i.e., "this method takes the percentage ratio between original values and a reference for each indicator" (Mazziotta & Pareto, 2017).

The *fourth step* is the most important step according to the authors (Mazziotta & Pareto, 2017), and it involves combining, or aggregating, all the elements of the index to form the composite index. Aggregation has three sub-steps, *compensatory nature*, weighting, and aggregation method. Regarding the compensatory nature, the researcher must articulate whether the index being developed is 1) Compensatory – i.e., a deficiency in one proxy can be substitutable, or compensatory, by another proxy, one such example is how the '% of primary students enrolled in school' is compensatory with the '% of secondary students enrolled in school'; 2) Non-compensatory – i.e., the proxies are non-substitutable; or 3) Partially-compensatory – i.e., the proxies are substitutable to some degree. Regarding the *weighting* of the elements of the index, a weighting system must be adopted, i.e., equal weights, expert weighting, subjective weighting, or principal component analysis. Regarding the *aggregation method*, the most popular method according to the authors (Mazziotta & Pareto, 2017) are the arithmetic and geometric methods. The arithmetic mean is the most commonly used aggregation method among the most popular indicators (Mazziotta & Pareto, 2017), and it is usually adopted for compensatory indices. The geometric method on the other hand is commonly used for partially and non-compensatory composite indices. Instead of an additive approach, this method utilizes multiplicative functions (Mazziotta & Pareto, 2017). In summary, the first and most important step when aggregating the indicators is to identify the compensatory nature of the index being developed. After that, the researcher can then decide to whether utilize additive aggregation methods such as arithmetic mean and principal component analysis for his compensatory index, or the geometric mean or multi-criteria analysis if his index is partially or non-compensatory.

The *fifth step* involves assessing the *validity* and *robustness* of the index being developed, and this can be achieved by utilizing sensitivity analysis, i.e., "how much each individual source of uncertainty contributes to the output variance" (Mazziotta & Pareto, 2017), and uncertainty analysis, i.e., "how uncertainty in the input factors propagates through the structure of the composite index and affects the results" (Mazziotta & Pareto, 2017).

Like Mazziotta-Pareto Index (MPI) (2013), this study adopts a *non-compensatory* path (Figure no. 1) in the construction of the BBI, with the exception of the weighting method.

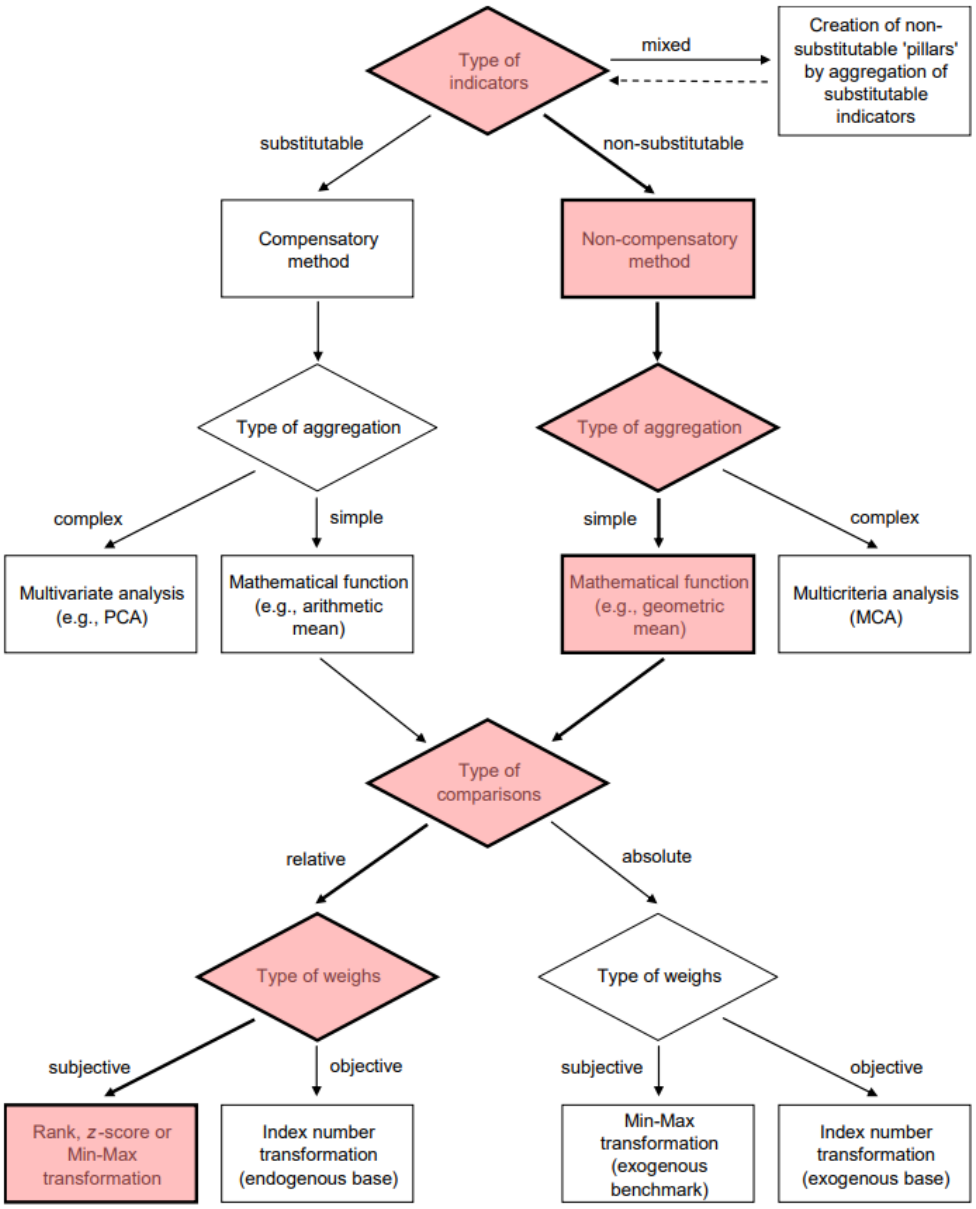

Figure no. 1 – The BBI follows a non-Compensatory, geometric, ranking based, and expert weighting approach (Based on MPI by Mazziotta and Pareto (2013), except for the weighting system)

Sources: Mazziotta and Pareto (2013)

3.2 Proxy Selection

What justification exists for selecting the proxies? As stated earlier, the BBI proxies represent the behavior a worthless fellow would engage in, which subsequently leads to societal harm. In addition to selecting proxies which align with the theories which form the basis of the BBI framework, the BBI proxies are also selected based on theory, supporting literature, and rational reasoning. To elaborate, proxies are selected to reflect prominent theories in academic literature, within the context of development, such as Alesina et al. (1996) seminal study on political instability, endogenous growth theory (Romer, 1994), resource curse theory (Auty, 1995) et al. Moreover, proxies were also selected based on evidence from academic literature such as Scully's (1992) views on economic freedoms, and how they lead to countries that are highly efficient at inputs into outputs; N'Zue's (2018) position on reducing pollution, and how it can support sustainable growth as well as improving societal welfare; and Wahyudi et al.'s (2021) who posit that lower levels of corruption lead to higher levels of development and quality of life. The theories and supporting literature which justify the selection of the BBI proxies due to their impact on the economic and social well-being of countries are presented as follows: 1) Economic Freedoms (Scully, 1992; Doucouliagos & Ulubasoglu, 2006; Williamson & Mathers, 2011; Piątek et al., 2013; Hussain & Haque, 2016; Brkić et al., 2020; Gezer, 2020); 2) Monopolistic Markets (Bae et al., 2021); 3) Resource Curse Thesis (Auty, 1995; Sachs & Warner, 2001); 4) Unemployment (Kukaj, 2018; Priambodo, 2021); 5) Savings (Krieckhaus, 2002; Misztal, 2011); 6) Inflation (Akinsola & Odhiambo, 2017; Yolanda, 2017); 7) Infrastructure (Kusharjanto & Kim, 2011; Palei, 2015; Mohanty et al., 2016; Apurv & Uzma, 2021); 8) Money Laundry (Argentiero et al., 2008; Kumar, 2012; Hetemi et al., 2018; Šikman & Grujić, 2021); 9) Corruption (Mo, 2001; Akçay, 2006; Popova & Podolyakina, 2014; Absalyamova et al., 2016; Wahyudi & Alfian, 2021); 10) Political instability (Alesina et al., 1996; Uddin et al., 2017; Yamarik & Redmon, 2017); 11) Rule of Law (Rodrik et al., 2004; Rigobon & Rodrik, 2005; Luong et al., 2020); 12) Social Dissension (Weber, 1958; Ibn Khaldūn, 1967; Fukuyama, 2001; Iyer et al., 2005); 13) Knowledge Creation (Romer, 1994; Solarin & Yen, 2016; Pinto & Teixeira, 2020); 14) Food Loss & Waste (Vilariño et al., 2017) 15) Access to Clean Water (Nawaz & Alvi, 2017; Kong et al., 2020); 16) Suicide Rates (Shepard et al., 2016; Kinchin & Doran, 2017); 17) Environmental Footprint (Azam et al., 2016; N'Zué, 2018). In summary, the 17 proxies which make up the BBI and pertain to 8 dimensions (Table no. 1), i.e., Economic, Corruption, Political, Governance, Social, Knowledge, Health, and Environmental dimensions, are anchored by the theories which make up the BBI framework and supported by literature which studies the impact of various variables on development.

Table no. 1 – BBI Proxies Summary

	Measure	Coun-tries	Vari-ables	Data Source
D1: Bad Economic Behavior				
1) Restricting Economic Freedoms (EF)	Economic Freedom Index	179	5	https://www.heritage.org/index
2) Monopolistic Markets (MM)	The Herfindahl-Hirschman Index	174	-	https://wits.worldbank.org
3) Rentierism (RENT)	Oil Rent as a % of GDP	187	-	https://data.worldbank.org
4) Unemployment (UR)	Unemployment Rate	187	-	https://data.worldbank.org

	Measure	Coun-tries	Vari-ables	Data Source
5) Inflation (INF)	Consumer price index (2010 = 100)	184	-	https://data.worldbank.org
6) Poor Savings (SAV)	Gross domestic savings (% of GDP)	177	-	https://data.worldbank.org
7) Poor Infrastructure (INFRA)	The Global Food Security Index	113	-	https://impact.economist.com
D2: Corruption				
8) Money Laundry (AML)	AML Index	140	17	https://index.baselgovernance.org
9) Public Sector Corruption (CPI)	Corruption Perception index	180	13	https://www.transparency.org/en
D3: Bad Political Behavior				
10) Political Instability (PI)	Fragile States Index	176	4	https://fragilestatesindex.org
D4: Poor Governance				
11) Poor Rule of Law (RL)	World Governance Indicators	154	8	https://data.worldbank.org
D5: Bad Societal Behavior				
12) Social Dissension (SD)	Prosperity Index Measure of "Social Capital"	167	17	https://www.prosperity.com
D6: Poor Knowledge Creation				
13) Poor Academic Influence (KC)	Research Output per capita	197	-	https://www.scimagojr.com/; https://data.worldbank.org/
D7: Preserving Health				
14) Food Loss & Waste (FLW)	The Global Food Security Index	113	-	https://impact.economist.com/
15) Poor Access to Clean Water (CLNW)	The Global Food Security Index	113	-	https://impact.economist.com/
16) Suicide Rates (SR)	Suicide Rate per 100K	183	-	https://who.int/
D8: High Environmental Footprint				
17) CO2 Emissions Per Capita (CO2E)	CO2 Emissions Per Capita	191	-	https://data.worldbank.org

In addition to being aligned with theory on the causes of poor development, the BBI proxies must also align with the purpose of this research, as well as with the study's theoretical framework. To elaborate, this research aims to develop a composite measure which is influenced by the holistic and multidimensional nature of Ibn Khaldun's 'Theory of Development', i.e., there are many elements which lead to the rise and fall of nations including but not limited to economic well-being, political authority, justice, behavior et al.

Given that the theoretical justification for measuring behavior is based on the concept of Mafsada in the Maqasid of Shariah and Adam Smith's worthless fellow in TMS, so are the proxies selected for the index. To elaborate, the corollaries of Mafsada, i.e., the behavior or outcomes which lead to societal harm, and the behavior which a worthless fellow would engage in, serve as drivers for the proxies selected. Regarding the former, the selected proxies must be the anti-thesis of the purpose of the 5 dimensions of the Maqasid, i.e., 1) preserving religion; 2) preserving wealth, including the sustainable use of earth's natural resource; 3) preserving the mind; 4) preserving the body, whilst gaining and utilizing knowledge for the betterment of mankind; and finally, 5) propagating earth to ensure the continuation of mankind. Regarding the latter, Smith's simple categorization of man as a man of honor or a

worthless fellow can facilitate the proxy selection process, as well as provide a theoretical basis for measuring the behavior of nations, i.e., the BBI can measure how 'honorable' or 'worthless' these countries are if they were to be judged as a man. In short, the proxies must be in accordance with theory and literature as to the behavior a worthless fellow would engage in and consequently cause societal harm, i.e., restricting economic freedoms, political instability, corruption etc. The justification for selecting the BBI proxies is presented in the Annex (Table no. A-1), whilst the proxies and their corresponding Maqasid are presented in Annex (Table no. A-2).

3.3 Proxy Adjustment

For some of the composite measures included, i.e., Economic Freedom Index, some of the variables which make up these measures were excluded to avoid double counting. To elaborate, there are 12 variables included in the measurement of the economic freedom index: Property Rights, Judicial Effectiveness, Government Integrity, Tax Burden, Government Spending, Fiscal Health, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, and Financial Freedom. Of those 12 variables 6 variables pertain to economic freedoms: Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, and Financial Freedom. Of those variables 'Monetary Freedom' was excluded as it includes inflation as a proxy, which has been already included as a proxy under 'Inflation – Consumer Price Index'. As such, only 5 of the variables which make up the Economic Freedom Index are included in the construction of the BBI, whilst 7 variables were excluded. This exclusion procedure was repeated where necessary, and no other issues pertaining to double counting are present within the dataset to the best of the authors knowledge.

3.4 Data Sources & Limitations

The BBI proxies are composed of secondary data that has been collected from 'World Bank', 'Heritage Foundation', 'World Values Survey', 'The Fund for Peace', 'Transparency International', 'Basel Institute', 'Legatum Institute', 'UNESCO', 'SCIMAGO', 'The Economist Intelligence Unit', among others (Table no. 1).

Regarding the data limitations, the primary limitation of the data is its secondary nature, as it might not be a true reflection of the phenomena being measured. Given that this study seeks to quantify the development hindering behavior of individuals and institutions and given the lack of theoretical framework which facilitates such quantification, the study must resort to the use of secondary data which could be plagued by: 1) missing data for certain years or countries; lack of data pertaining to the issue the researcher is attempting to study; human error in the data collection process; lack of transparency in the data collection process; among others. Nonetheless, in the absence of primary data which could be of more relevance to the issues being studied, the use of secondary data is justified even if they are not a true reflection of the issues the researcher is attempting to study, as long as there are similarities (Chandola & Booker, 2022).

3.5 BBI selected Countries (N) & Year (t)

The present study aims to construct a composite index using data collected from over 150 countries. However, data is missing for the proxies of 'Food Waste' and 'Poor Access to Clean Water,' which reduces the number of countries included to 89. In addition, data is available for over 15 years for all proxies except 'Money Laundering,' 'Public Sector Corruption', 'Food Waste', and 'Poor Access to Clean Water'. As a result of limited data availability for recent years, the composite index presented in this study was constructed for the year 2019 with the aim of reducing data unavailability as the selected year produced the highest number of countries with the least amount of missing data without excessive interpolation and forecasting – less than 2%. Although data could have been forecasted for the proxies with missing data to include more countries in the BBI or select a more recent dataset, it was decided not to do so to limit data discrepancies. The list of countries included in the index are presented in Table no. 2 as follows:

Table no. 2 – Countries included in the BBI

Europe	Asia	Africa	NA	SA & CA	Oceania
Austria	Azerbaijan	Algeria	Canada	Bolivia	Australia
Belgium	Bahrain	Angola	Mexico	Brazil	New
Bulgaria	Cambodia	Benin	United	Chile	Zealand
Czech Republic	China	Botswana	States	Colombia	
Denmark	Egypt	Burkina Faso		Costa Rica	
Finland	India	Ghana		Dominican	
France	Indonesia	Ivory Coast		Republic	
Germany	Japan	Kenya		Ecuador	
Greece	Jordan	Morocco		El Salvador	
Hungary	Kazakhstan	Mozambique		Guatemala	
Ireland	Kuwait	Niger		Honduras	
Italy	Laos	Nigeria		Nicaragua	
Netherlands	Malaysia	Senegal		Panama	
Norway	Nepal	Sierra Leone		Paraguay	
Poland	Pakistan	South Africa		Peru	
Portugal	Philippines	Tanzania		Uruguay	
Romania	Qatar	Tunisia			
Russia	Saudi Arabia	Uganda			
Serbia	Singapore	Zambia			
Slovakia	South Korea				
Spain	Sri Lanka				
Sweden	Thailand				
Switzerland	United Arab				
Turkey	Emirates				
Ukraine	Vietnam				
United Kingdom					

3.6 Interpolation & Forecasting

Missing values for the entire dataset are *less than ~2%* after reducing t & N, and the missing data has been interpolated using the *moving-average* method which is an interpolation and forecasting technique which places higher weights for more recent values when calculating the missing data.

3.7 Data Normalization

Regarding the *normalization* method, this research utilizes the *ranking* approach. This approach ranks countries in each proxy, and its advantage over the other methods is that it is not affected by outliers (Mazziotta & Pareto, 2017). The ranking formula is presented as follows:

$$y_{ij} = rank(x_{ij})$$

where *'rank(x_{ij})'* is the rank of Country *'i'* for proxy *'j'*.

The ranking method is useful against outliers, variables with positive, negative, or zero values, and is applicable to both bounded and unbounded variables. However, its limitation is the assumption of equal intervals between the variables and is not suitable for ordinal data (Mazziotta & Pareto, 2017). Regarding the treatment of countries with equal scores for a particular proxy, i.e., share the same rank, the dataset will be subjected to the *soft-max* technique which transforms the vectors from numbers to probabilities. The formula for the soft-max function is as follows:

$$\sigma(x_j) = \frac{e^{x_j}}{\Sigma_i e^{x_i}}$$

3.8 Data Aggregation

Regarding the aggregation method, this research seeks to develop a non-compensatory index, which means the most appropriate method is the geometric or the multi-criteria analysis. Given the prominent use of the geometric mean in literature, this research will adopt this method of aggregation. Similar to Zhou et al.'s (2010) model, the BBI model with the application of the geomean method is presented as follows:

$$BBI_i^0 = \prod_{j=1}^{n} y_{ij}^{w_j} \qquad i = 1, 2\ldots \text{m}$$

where…

- *'y_{ij}'* represents the '*BBI*' score for country *'i'* with respect to proxy *'j'*.
- *'n'* represents the number of proxies included in the BBI.
- *'m'* represents the number of country's included in the BBI.
- *'w_i'* represents the weight to be applied to proxy *'j'*.

It must be noted that the the BBI is a *negative index*, meaning that countries will be ranked in a descending order of highest to lowest engagement in development hindering behavior, i.e., highest to lowest levels of bad behavior.

3.9 Weighting Method

Regarding the *weighting* system adopted, the index will adopt an *expert weighting* system, which involves consulting a panel of experts and delegating them the task of assigning

the weights to the proxies via scale of relative importance. Although expert weights are more reliable than equal or arbitrary weights, they are troubled by subjectivity and inconsistency. To address this limitation, the expert weights are integrated with the *Fuzzy Analytic Hierarchy Process* (FAHP). This process subjects the proxies to a 1v1 comparison through a Fuzzy Pairwise Comparison Matrix (FPCM) which facilitates for identifying the most important proxies pertaining to the phenomenon being measured. The FAHP method is based on Zadeh's (1965) fuzzy sets theory, and Saaty's (2010) AHP method for Multi-Criteria Decision Making (MCDM).

The methodology behind integrating the expert weighting system and the FAHP method is based on Al Fozaie and Wahid (2022), and it involves 1) Developing a weighting scale based on a scale of relative importance; 2) Selecting a panel of experts and delegate the weighting process; 3) Assigning alpha values to the experts based on their level of expertise; 4) Transforming the survey responses into expert weights; 5) Applying the FAHP method to the expert weights; 6) Normalizing the fuzzy weights to produce the interval weights which are midpoint between the fuzzy weights and the expert weights, and are the final weights to be applied to the BBI.

To summarize how the study came about the BBI weights, expert weights were generated with the support of 5 experts of the field of economics, who are asked to individually assign weights to the BBI proxies using a scale of relative importance. The internal consistency score of the survey responses was 0.932, which indicates that the expert responses are highly consistent, allowing one to proceed with the expert weighting and FAHP integration process. To improve upon the expert weights, alpha values were assigned to the experts, and their responses and were recalculated using the soft-max function. A Pearson correlation test was conducted to check the consistency of the expert weights pre- and post-alpha adjustment, which returned a value of 0.985 which indicates that the alpha adjustments have not skewed the results and the expert opinions are consistent.

Regarding the FAHP process, a fuzzification of the expert weights was conducted, which involved developing a fuzzy pairwise comparison matrix to synthesize the judgements of the panel experts, as well as provide a vis-à-vis comparison of the proxies. Calculating the fuzzy weights followed, which involved utilizing the geometric mean (Buckley, 1985) to aggregate multiple fuzzy sets into a single set. De-fuzzying the weights followed, which involves calculating the average of the fuzzy weights for each proxy. The last step is to find the interval weights which are the midpoint between the expert weights and the fuzzy weights. The interval weights address the limitation of highly exaggerated or skewed fuzzy weights by normalizing them and bringing them closer to the expert values, but not to the extent that the FAHP method and subsequent fuzzy weights become obsolete. Figure no. 2 provides a summary of the process of generating the expert weights, integrating them with the FAHP method, and transforming them into interval weights, whereas Table no. 3 exhibits the fuzzy weights, expert weights, and the interval weights, the latter of which will be applied to the BBI.

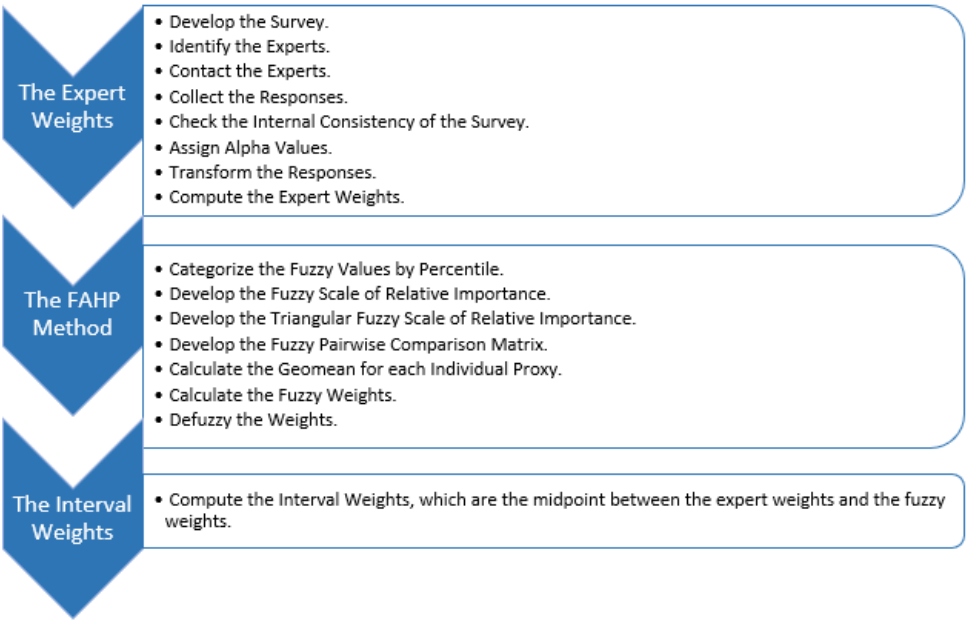

Figure no. 2 – BBI weighting process
Sources: Al Fozaie and Wahid (2022)

Table no. 3 – Fuzzy Weights, Expert Weights, and the Interval Weights

Proxy	w_i[1]	w_i[2]	Interval w_i[3]
CPI	15.80%	7.10%	**11.50%**
PI	15.80%	7.20%	**11.50%**
EF	15.80%	7.00%	**11.40%**
RL	8.50%	6.70%	**7.60%**
MM	8.50%	6.40%	**7.40%**
INFRA	8.50%	6.20%	**7.40%**
CLNW	4.10%	6.00%	**5.10%**
INF	4.10%	5.90%	**5.00%**
KC	4.10%	5.80%	**5.00%**
SAV	4.10%	5.80%	**4.90%**
UR	2.10%	5.70%	**3.90%**
RENT	2.10%	5.40%	**3.70%**
AML	2.10%	5.40%	**3.70%**
SD	1.10%	5.30%	**3.20%**
FLW	1.10%	5.10%	**3.10%**
CO2E	1.10%	5.00%	**3.00%**
SR	1.10%	4.10%	**2.60%**

Note: [1] Fuzzy Weights; [2] Expert Weights; [3] Interval weights which are the midpoint between the fuzzy weights and the expert weights.

FAHP Benefits & Limitations

The advantage of the FAHP method is that it facilitates for a 1v1 comparison of the proxies, which the scale of relative importance does not allow, thereby serving a similar role to principal component analysis (PCA) where the most prominent proxies become apparent. The difference between PCA and FAHP is that the former can only be applied to compensatory indices, whilst the latter does not have such limitation (Mazziotta & Pareto, 2017). However, it has been argued that the FAHP method adds unnecessary fuzziness to the AHP method (Saaty, 2006). Moreover, the FAHP does not entirely eliminate the subjectivity, uncertainty, and inconsistency of the expert opinions, it rather mitigates their effect. That said, integrating expert weights with the FAHP method should result in weights which are more accurate relative to equal or arbitrary weights. Evidence to this statement is the ranking of the proxies in Table no. 3, which is supported by theory and literature as the most important drivers for socio-economic development. Moreover, the discussion section provides a comparison between the BBI rankings with and without the application of the FAHP method, and as it will become clearer later on, the application of the FAHP method is justified.

3.10 Diagnostic Methods

Regarding the *validity* testing, the index will be tested for robustness using both *sensitivity* and *uncertainty* analysis. Sensitivity analyses involves quantifying the effects of each individual uncertainty, or parameter variations, on the results or outputs (Saisana *et al.*, 2005; Mazziotta & Pareto, 2017; Greco *et al.*, 2019). Uncertainty analysis centers on the effects of parameter uncertainties, and how the uncertainties in the inputs can impact the results or outputs (Ibid, 2005). The benefit of validity testing is that it adds a level of transparency to the index construction process, aids in the proxy selection process, and conveys a level or robustness which dispels the criticism of using composite indices (Saisana *et al.*, 2005; Mazziotta & Pareto, 2017; Greco *et al.*, 2019).

Correlation analysis was also conducted to study the relationship between the proxies. Highly correlated indices could lead to double counting and skew the index (OECD & Joint Research Centre-European Commission, 2008). However, this can be considered a non-issue if a 'false-positive' relation exists between the variables. To elaborate, two proxies could be highly correlated even though they measure different phenomena. The recommended course of action is to judge each instance where there is high correlation among the variables, i.e., a correlation coefficient of +/- 0.7 to 1.0 (Ratner, 2009), on a case-by-case basis, i.e., a vis-à-vis comparison of the indicators with high correlation.

3.11 BBI Methodology Summary

The BBI consist of 17 proxies pertaining to different measures of bad behavior by individuals and institutions. The data has been normalized using the ranking approach and missing data has been interpolated using the moving average method. In addition, data has been aggregated using the geomean method, and the weighting method of choice is the integration of expert weights and the FAHP method to arrive at the interval weights, which are more objective and reliable relative to expert weights, equal weights, or arbitrary weights. In addition to the forestated, the methodology includes diagnostic tests to check for the

reliability and validity of the index results, which involves conducting sensitivity, uncertainty, and correlation analysis. Except for the weighting method, the study follows the methodology of Mazziotta and Pareto (2017) for the construction of composite indices.

4. RESULTS

4.1 Index Results

Table no. 4 – BBI results

Rank	Country	Rank	Country	Rank	Country
1	Angola	31	South Africa	61	Poland
2	Sierra Leone	32	Guatemala	62	South Korea
3	Nigeria	33	Serbia	63	Slovakia
4	Mozambique	34	Colombia	64	Panama
5	Nepal	35	Egypt	65	Hungary
6	Nicaragua	36	Ecuador	66	United Arab Emirates
7	Ukraine	37	Dominican Republic	67	Canada
8	Niger	38	Sri Lanka	68	Italy
9	Burkina Faso	39	Mexico	69	United States
10	Zambia	40	Vietnam	70	Qatar
11	Laos	41	Morocco	71	Japan
12	Kenya	42	Peru	72	Australia
13	Uganda	43	El Salvador	73	Czech Republic
14	Bolivia	44	Turkey	74	Portugal
15	Brazil	45	Philippines	75	Spain
16	Pakistan	46	Jordan	76	New Zealand
17	Algeria	47	Botswana	77	Belgium
18	Ivory Coast	48	Costa Rica	78	Austria
19	Benin	49	China	79	France
20	Tunisia	50	Uruguay	80	Norway
21	Ghana	51	Indonesia	81	United Kingdom
22	Tanzania	52	Saudi Arabia	82	Finland
23	Kazakhstan	53	Kuwait	83	Ireland
24	India	54	Bulgaria	84	Netherlands
25	Russia	55	Romania	85	Germany
26	Honduras	56	Thailand	86	Denmark
27	Paraguay	57	Greece	87	Sweden
28	Cambodia	58	Chile	88	Singapore
29	Senegal	59	Malaysia	89	Switzerland
30	Azerbaijan	60	Bahrain		

Figure no. 3 provides a visual illustration in the form of a heat map of the BBI rankings. Countries are color coded where the blue spectrum represents countries that are lower in the index, i.e., lowest engagement in development hindering behavior, whilst the red spectrum represents countries that are higher on the index, i.e., highest engagement in developing hindering behavior.

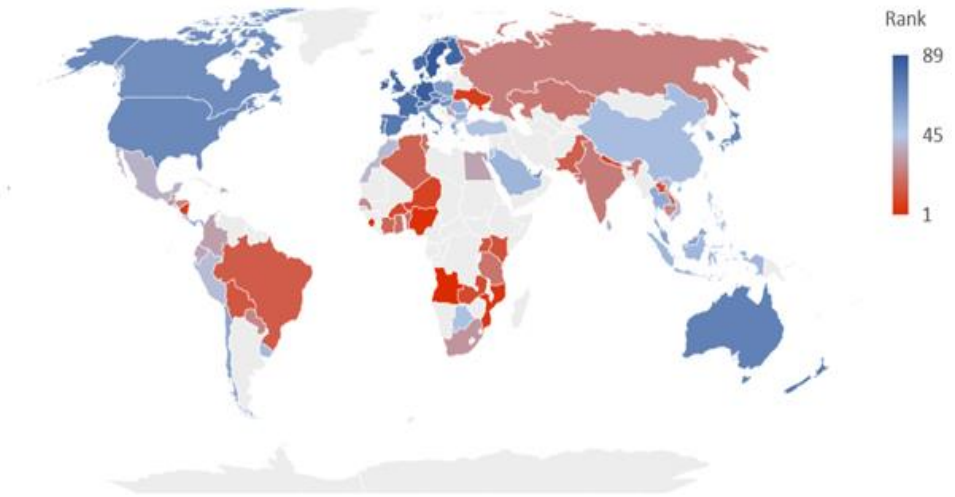

Figure no. 3 – BBI Heat Map

4.2 Diagnostic Results

Before moving on to analyzing and interpreting the BBI results, it is essential to discuss the validity of the results according to several diagnostic tests initiated. Beginning with a *correlation analysis* test conducted in R, various proxies are highly correlated to one another, i.e., a correlation coefficient of +/- 0.7. An example of such is the high and positive correlation between the proxy for *Money Laundry*, i.e., AML, and the proxy for *Poor Access to Clean Water*, i.e., CleanW. Another example of high correlation is the significant and negative relationship between the proxy for CO2 *Emissions*, i.e., CO2E, and the proxy of Poor *Infrastructure*, i.e., INFRA. There are many instances of high correlation as exhibited by Figure no. 4, but for the sake of directness and simplicity, the upcoming text will discuss the forestated examples.

Regarding the high correlation between Money Laundry and Poor Access to Clean Water, this is a case of a false-positive which should be ignored. The rationale behind such action is because both proxies are quite distinct from one another, as each proxy is a measure of a very different phenomenon. Regarding the high correlation between CO2 Emissions and Poor Infrastructure, not only do the two proxies measure phenomena which are distinctive, but there is a lack of a theoretical and rational reason for such a high and negative correlation. To elaborate, the significant and negative relationship between CO2 Emissions and Poor Infrastructure indicates that as CO2 Emissions per Capita increase, the quality of a country's road, port, air, and rail infrastructure decreases. Such a relation is inconceivable, as it is irrational to assume that as countries improve the quality of their infrastructure, which subsequently leads to higher air, road, and port traffic, the country's CO2 emissions per capita will decrease. As such, and despite the benefits of a correlation analysis, which facilitates for the exclusion of similar proxies which could lead to double counting and subsequently skewing the index, it does not always lead to accurate estimates as to the nature of the relationship between the proxies.

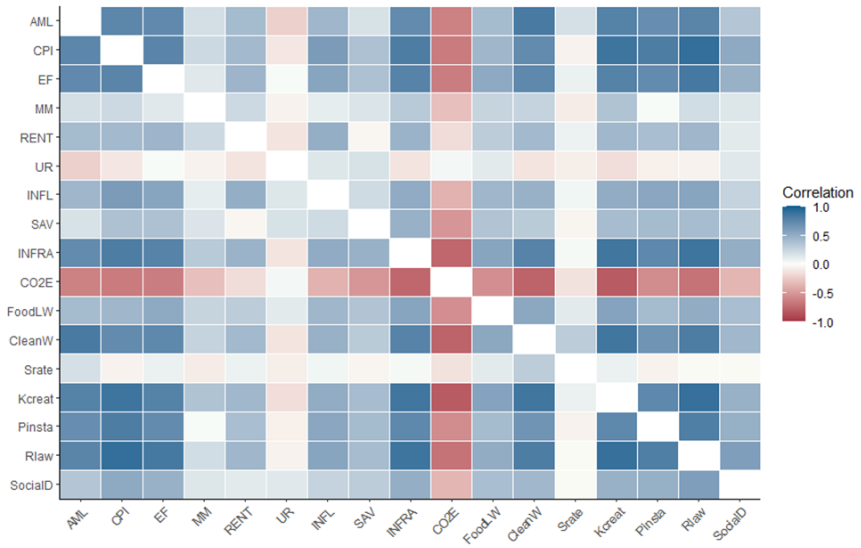

Figure no. 4 – BBI Proxies Correlation Heat Map

A better alternative is to engage in a vis-à-vis comparison to eliminate proxies which measure similar phenomena, or might include variables which could lead to double counting, i.e., just as this study has done by removing some of the variables which make up the economic freedom index as it only included 5 of the 12 variables which make up the index because they were irrelevant to the phenomena being measured, as well as due to the presence of measures such as inflation which is represented by the consumer price index in another proxy. Another proxy which had a similar treatment is the measure of political instability which is represented by the Fragile States Index (FSI). This measure includes 12 dimensions of which only 4 were selected based on their relevance to the phenomenon being measured, as well as to avoid conflict with other variables included in the index. Nevertheless, the index does include one measure which included double counted variables and that is the proxy for Money Laundry (AML). This proxy consists of 17 variables of which includes Corruption (CPI) [5% weight], Rule of Law [2.5% weight], and Bribery Matrix [5%] – albeit the latter 2 are from different sources. However, this should be of no impact on the outcome of the index as their influence on the AML index is a mere 0.46% [12.5% × 3.7%]. The reason for not removing these variables from the AML index is because the data source does not separate the variables relative to other data sources and present them as an aggregated value instead. No other issues pertaining to double counting are present in the index to the best of the researcher's knowledge.

Regarding the *sensitivity analysis*, which aims to estimate which of the input uncertainties are driving the output uncertainties (Becker, 2021), there are two types of uncertainties, i.e., the normalization method and the index weights, which were tested in R statistical software by subjecting the BBI to the Monte Carlo method, i.e., a technique which recalculates the index by manipulating the value of the uncertainties each time. According to the test results of 100 iterations, the BBI is highly sensitive to the weights and indifferent to the normalization method. Such findings indicate that the output of the index is highly

dependent on the weights selected, and changing these weights subsequently changes the BBI results. The results of the sensitivity analysis are presented in Figure's no. 5 & no. 6 which visualize the uncertainties in the form of a bar chart and a box plot. Given that the weights are the most important uncertainty in the aggregation process, it is of the utmost importance to perform high due diligence when selecting the weights for the BBI; hence why experts were delegated the weighting process, and their responses were transformed into expert weights, and subsequently integrated with the FAHP method to facilitate for a 1v1 comparison of the proxies, and assign the highest weights to the most important proxies to produce the fuzzy weights, which were then normalized to produce the interval weights, with the purpose of reducing skewness in the index.

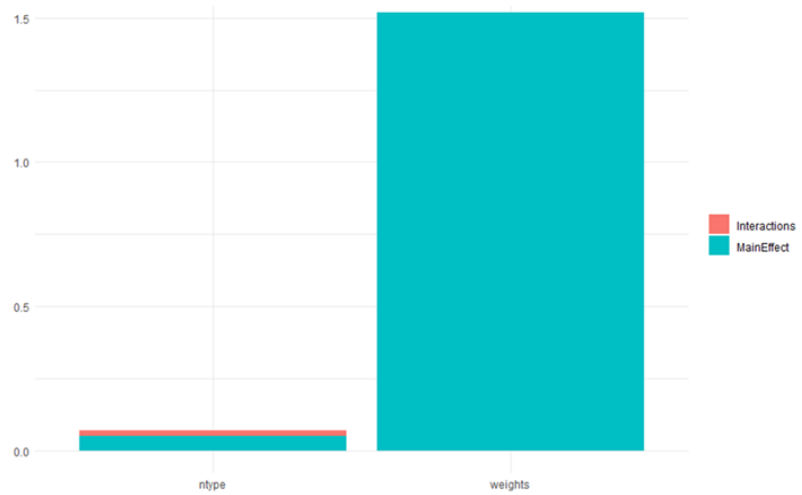

Figure no. 5 – Sensitivity Analysis: Bar Chart[1]

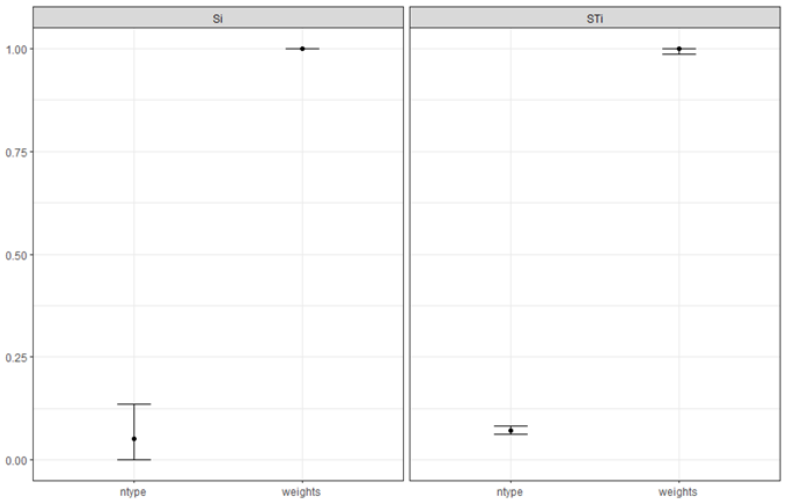

Figure no. 6 – Sensitivity Analysis: Box Plot

Regarding *uncertainty analysis*, which aims to quantify the uncertainty in the outputs, it was also conducted in R using a Monte Carlo simulation of 100 iterations, and the results are presented in Figure no. 7. According to the uncertainty analysis output, which plots the nominal, mean, and median ranks (y-axis) of various replications of the BBI, the results of the BBI are consistent for the countries included (x-axis), as the variance between the various ranks is insignificant given the linear nature of the chart. The interpretation of the uncertainty analysis test indicates that the BBI country ranks are fairly consistent given the multiple recalculations of the index, providing validity to the results of the index, as well as the greenlight to the researcher to proceed with the analysis and interpretation of the results.

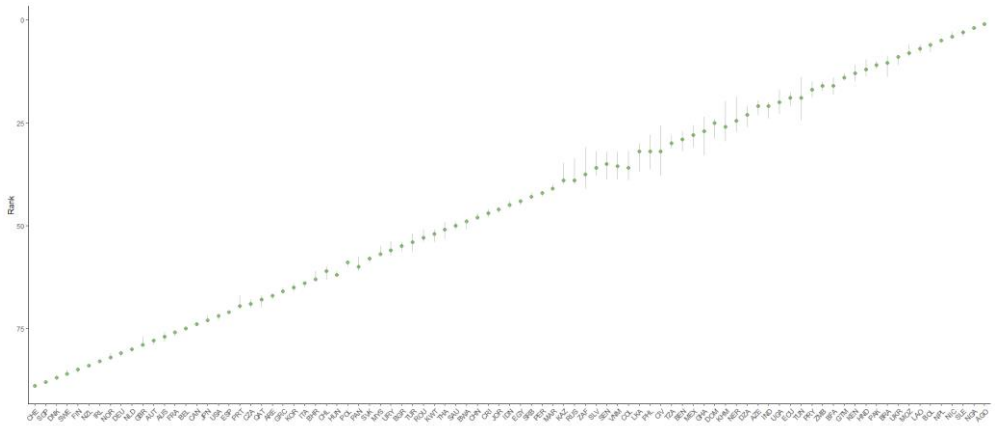

Figure no. 7 – Uncertainty Analysis

5. ANALYSIS & INTERPRETATION

The BBI is a negative index, meaning that countries that rank lower in the index are highly developed countries since they engage in the least levels of development hindering behavior relative to the other countries in the index. On the other hand, countries ranking higher on the index are highly underdeveloped countries, since they engage in the highest levels of development hindering behavior.

Analyzing and interpreting the BBI rankings involves breaking down the rankings into groups and clusters. The advantage of this method is that it provides a clearer picture of the rankings, i.e., allowing researchers to identify patterns, as countries are categorized based on variables such as geographic location, culture etc.

Regarding the grouping process, countries were grouped by region, i.e., geographic categorization, and divided into 11 groups. Grouping allows one to cluster countries that are quite similar to one another, i.e., grouping Norden countries such as Denmark, Finland, Sweden, and Norway. Grouping has many benefits, one of which is that it allows one to see how countries that share similar geographies and culture perform in the index, and whether there are any discrepancies in the rankings. To elaborate, if these countries perform well in the index, i.e., rank at the bottom end of the BBI, it provides one with valuable information which could lead to further research, i.e., why are Norden countries highly developed? If there are discrepancies in the rankings however, and despite sharing various geographic, cultural,

and social similarities, it also provides one with information which could lead to further research, i.e., why is country 'x' less developed than its neighbors' given similar geographic, cultural, and social facets? The grouping of countries by region is presented in Figure no. 8 as follows:

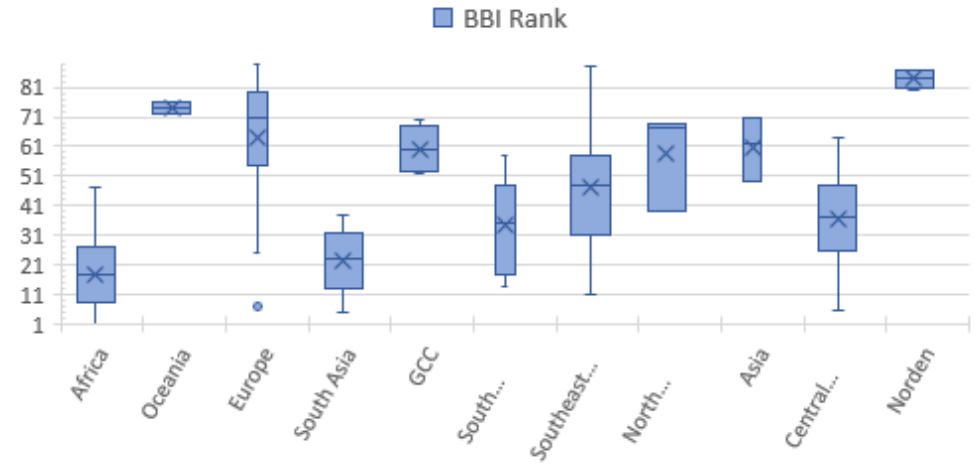

Figure no. 8 – BBI by Region

Regarding clustering, it facilitates for the categorization of countries into groups which could be quite distinct from one another, i.e., different geographies, culture, religion, language etc. Countries in the BBI are clustered based on their level of performance in the BBI, which itself is an indicator of the countries level of socio-economic development. To elaborate, countries are divided into four clusters, i.e., underdeveloped (Cluster 1), developed (Cluster 2) developing (Cluster 3), and highly developed (Cluster 4). Clusters were created using the percentile clustering technique discussed by Janowitz and Schweizer (1989) where countries are assigned a percentile value based on their rank in the BBI. Quantile clustering is utilized due to its simplicity and ease of use in partitioning data into clusters based on percentiles of a particular variable or rank. The use of percentiles ensures a well-balanced representation of the data, aiding in identifying outliers and making it an effective method for partitioning complex or heterogeneous data. It also helps at providing insights into unique characteristics or values within the data, making it a valuable tool in a wide range of applications.

The percentile method, i.e., 'p = 1-(ranki/n)', was adjusted to reflect the negative nature of the index, and an inverse percentile method was utilized instead, i.e., 'p = ranki/n' or '%-1' where 'p' is the percentile, 'ranki' is the rank of country 'i' in the index, and 'n' is the number of countries included in the index. For example, under the percentile method of Janowitz and Schweizer (1989), the percentile for Angola, which ranks first in the BBI, is 98.9%. Under the inverse percentile method, i.e., 'p-1', the percentile value of Angola is 1.12%. The use of inverse percentile method instead of the original percentile method in this study was chosen to provide a clearer visualization of the clusters. The negative nature of the index, which reflects development hindering behavior, was better represented using this method. Clustering countries into groups, rather than assigning absolute ranks, provides a more useful way to understand the results. While a country's rank in an index may not provide

actionable information, clustering countries into groups helps to identify patterns and trends. It is important to note that being part of the 'highly developed' cluster is a goal for countries. This cluster represents countries that exhibit low levels of development hindering behavior. The BBI index, like all indices, provides a simplified representation of reality and it is important to be aware of its limitations. It is not meant to be taken at face value, but rather as a starting point for analysis. Policy and decision makers should use the results of the index to identify areas where a country is lagging and how to improve its performance in the future. The results of clustering countries by level of socio-economic development using the inverse percentile method (%-1) are presented in Table no. 5:

Table no. 5 – Clusters by Development Status

Cluster 1 Underdeveloped		**Cluster 2 Developing**		**Cluster 3 Developed**		**Cluster 4 Highly Developed**	
Country	**%$^{-1}$**	**Country**	**%$^{-1}$**	**Country**	**%$^{-1}$**	**Country**	**%$^{-1}$**
Angola	1.1%	Kazakhstan	25.8%	Philippines	50.6%	Canada	75.3%
Sierra Leone	2.2%	India	27.0%	Jordan	51.7%	Italy	76.4%
Nigeria	3.4%	Russia	28.1%	Botswana	52.8%	USA	77.5%
Mozambique	4.5%	Honduras	29.2%	Costa Rica	53.9%	Qatar	78.7%
Nepal	5.6%	Paraguay	30.3%	China	55.1%	Japan	79.8%
Nicaragua	6.7%	Cambodia	31.5%	Uruguay	56.2%	Australia	80.9%
Ukraine	7.9%	Senegal	32.6%	Indonesia	57.3%	Czech Republic	82.0%
Niger	9.0%	Azerbaijan	33.7%	Saudi Arabia	58.4%	Portugal	83.1%
Burkina Faso	10.1%	South Africa	34.8%	Kuwait	59.6%	Spain	84.3%
Zambia	11.2%	Guatemala	36.0%	Bulgaria	60.7%	New Zealand	85.4%
Laos	12.4%	Serbia	37.1%	Romania	61.8%	Belgium	86.5%
Kenya	13.5%	Colombia	38.2%	Thailand	62.9%	Austria	87.6%
Uganda	14.6%	Egypt	39.3%	Greece	64.0%	France	88.8%
Bolivia	15.7%	Ecuador	40.4%	Chile	65.2%	Norway	89.9%
Brazil	16.9%	Dominican	41.6%	Malaysia	66.3%	United Kingdom	91.0%
Pakistan	18.0%	Republic		Bahrain	67.4%	Finland	92.1%
Algeria	19.1%	Sri Lanka	42.7%	Poland	68.5%	Ireland	93.3%
Ivory Coast	20.2%	Mexico	43.8%	South Korea	69.7%	Netherlands	94.4%
Benin	21.3%	Vietnam	44.9%	Slovakia	70.8%	Germany	95.5%
Tunisia	22.5%	Morocco	46.1%	Panama	71.9%	Denmark	96.6%
Ghana	23.6%	Peru	47.2%	Hungary	73.0%	Sweden	97.8%
Tanzania	24.7%	El Salvador	48.3%	United Arab	74.2%	Singapore	98.9%
		Turkey	49.4%	Emirates		Switzerland	100.0%
Mean	**12.9%**	**Mean**	**37.6%**	**Mean**	**62.4%**	**Mean**	**87.6%**

5.1 Integrating the inverse percentile method and grouping by region

The inverse percentile method can also be applied to the BBI results by group, i.e., similar geographies and culture, to provide a visual illustration of the rankings for the purpose of further analysis. The results of such integration and provided in Table no. 6 and visualized in Figure no. 9.

Table no. 6 – BBI Results by Region Summary

Region	Avg of BBI Rank	Avg of $\%^{-1}$ Rank
Africa	18.10	20.3%
Asia	60.67	68.2%
Central America	36.57	41.1%
Europe	64.09	72.0%
GCC	60.20	67.6%
Norden	83.75	94.1%
North America	58.33	65.5%
Oceania	74.00	83.1%
South America	34.50	38.8%
South Asia	22.67	25.5%
Southeast Asia	47.25	53.1%

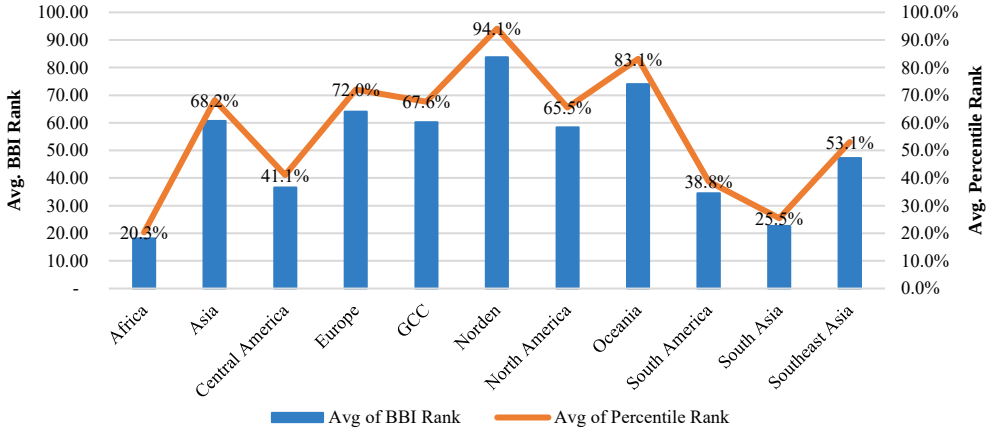

Figure no. 9 – BBI Results by Region visualized

Analyzing the BBI results by region, i.e., Figure's no. 8 & no. 9, and Table no. 6, countries that pertain to the Norden region perform highly in the index with an average BBI rank of 84 among 89 countries. This places Norden countries in the 94th percentile in terms of level of development. It must be noted that the ranking variability of Norden countries is minimal given the short length of their boxplot in Figure no. 8. Oceanian countries, i.e., Australia and New Zealand, rank second highest in the index with an average BBI rank of 74 and a percentile of 83%. European countries rank third in the index with an average BBI rank of 64 and a percentile of 72%. Of the 22 European countries included in the BBI, 52% are considered highly developed, i.e., cluster 4, 27% are considered developed, i.e., cluster 3, 14% are considered developing, i.e., cluster 2, and 5% are considered developing, i.e., cluster 1. African countries are considered the poorest performing countries in the index, i.e., they rank highly in the BBI, with an average rank of 18 and a percentile of 20%. No African country is categorized as a highly developed country, whereas only 1 African country, i.e., Botswana, is considered as a developed country. The rest of the African countries included in the index, i.e., 19 out of 20 countries, are categorized either as developing or underdeveloped countries. A full breakdown of the clusters by region and their respective socio-economic development status categorization are provided in Table no. 7 as follows:

Table no. 7 – Clusters by Region

Cluster 1 Underdeveloped			Cluster 2 Developing			Cluster 3 Developed			Cluster 4 Highly Developed		
Region	**#**	**%[-1]**	**Region**	**#**	**%[-1]**	**Region**	**#**	**%[-1]**	**Region**	**#**	**%[-1]**
Africa	15	68%	Africa	4	18%	Europe	6	27%	Europe	12	52%
South America	2	9%	Central America	4	18%	GCC	4	18%	Norden	4	17%
South Asia	2	9%	South America	4	18%	Southeast Asia	4	18%	North America	2	9%
Central America	1	5%	South Asia	4	18%	Asia	3	14%	Oceania	2	9%
Europe	1	5%	Europe	3	14%	Central America	2	9%	Asia	1	4%
Southeast Asia	1	5%	Southeast Asia	2	9%	South America	2	9%	GCC	1	4%
Asia	0	0%	North America	1	5%	Africa	1	5%	Southeast Asia	1	4%
GCC	0	0%	Asia	0	0%	Norden	0	0%	Africa	0	0%
Norden	0	0%	GCC	0	0%	North America	0	0%	Central America	0	0%
North America	0	0%	Norden	0	0%	Oceania	0	0%	South America	0	0%
Oceania	0	0%	Oceania	0	0%	South Asia	0	0%	South Asia	0	0%

Grouping and clustering countries by region, development status, or otherwise, can facilitate the identification of patterns that warrant further research. For instance, 91.3% of the countries in the highly developed cluster are OECD members. This observation raises various questions that can be investigated in future research, such as the impact of the OECD's anti-bribery convention on corruption levels in its member countries and its potential effect on development. In addition, one might explore how political instability in Africa influences the level of development in the continent and why a country like Botswana, with a BBI rank of 47 among 89 countries, is in the top 74th percentile in the proxy for political instability (PI), while other African countries are in the 28th percentile, with an average rank of 16.5 among 89 countries. These questions are illustrative of how grouping and clustering can aid in analyzing and interpreting indices, rather than relying solely on absolute ranks.

5.2 Proxy Comparison for selected Countries

Despite the benefits of grouping and clustering over absolute ranks, including how they highlight the discrepancies in the development level of countries with similar characteristics, these methods do not facilitate in explaining such discrepancies. To achieve such purpose, one can either: 1) develop an economic model and conduct a regression analysis to test the relationship between various variables on the country ranks in the BBI by utilizing dynamic panel data and applying the generalized method of moments (GMM) estimation technique developed by Arellano and Bover (1995), i.e., difference GMM, or Blundell and Bond (1998), i.e., system GMM, to address the problem of endogeneity and heteroskedasticity in simple linear regression models; or 2) select a sample of countries at the higher and lower spectrums of the BBI and analyze their performance using a proxy comparison technique.

Regarding the selection of the countries in the sample, countries pertaining to the 'highly developed' cluster were selected along with the country which ranks highest on the BBI, i.e., Angola. The basis for selecting the countries is development status and geographic location. Selecting countries from diverse cultures and geographies in cross-country comparisons has several benefits. It allows for a more comprehensive understanding of how cultural and geographical factors impact development. This information can inform researchers and decision-makers by showing how development-promoting or hindering behaviors may vary across different cultural and geographical contexts. Thus, incorporating diverse countries in

cross-country comparisons provides a more nuanced understanding of the relationships between behavior, culture, geography, and development outcomes. The sample of countries and their respective performance in the form of percentiles, based on Janowitz and Schweizer (1989) and not the inverse percentile method discussed earlier, are presented in Table no. 8 as follows:

Table no. 8 – Proxy Comparison based on percentiles for selected countries

Proxy	Angola %	Switzerland %	Singapore %	New Zealand %	Qatar %
EF	93%	8%	1%	3%	42%
MM	90%	34%	33%	73%	62%
RENT	99%	2%	1%	53%	96%
UR	76%	49%	22%	44%	1%
INF	100%	1%	26%	25%	31%
SAV	16%	12%	3%	49%	2%
INFRA	80%	2%	1%	19%	28%
AML	78%	36%	25%	2%	37%
CPI	98%	4%	7%	1%	26%
PI	71%	1%	9%	4%	38%
RL	92%	8%	6%	2%	27%
SD	89%	7%	24%	4%	22%
KC	100%	1%	3%	13%	25%
FLW	89%	30%	34%	2%	51%
CLNW	90%	16%	17%	47%	49%
SR	83%	49%	71%	36%	22%
CO2E	15%	69%	83%	79%	97%
Average	**80%**	**19%**	**21%**	**27%**	**39%**

5.3 Angola & the BBI: Leading the Rankings

The BBI rankings in Table no. 4 show that Angola exhibits the highest levels of bad behavior relative to other countries in the index. To better understand why Angola leads the BBI rankings, it is imperative to analyze its performance in the various BBI proxies, and why it is categorized as an underdeveloped country despite its abundant natural resources – Angola ranks above 22 other countries with a rank of 67 out of 89 and is regarded as one of the world's largest exporters of oil (IEA, 2021).

Analyzing their performance in the various BBI proxies exhibited in Table no. 8, Angola is performing poorly in most indicators. For example, the country ranks in the 90th percentile in the proxies of 'Restricting Economic Freedoms' (EF), 'Monopolistic Markets' (MM), 'Rentierism' (RENT), 'Inflation' (INF), 'Public Sector Corruption' (CPI), 'Poor Rule of Law' (RL), 'Poor Knowledge Creation' (KC), and 'Poor Access to Clean Water' (CLNW). All in all, the country performs poorly in all of the BBI proxies, i.e., assuming a threshold of 70th percentile, with the exception of their performance in the proxies for 'Poor Savings' (SAV) and 'CO2 Emissions Per Capita' (CO2E). According to Munslow (1999) & García-Rodríguez *et al.* (2015), Angola is poorly developed despite the abundance of natural oil resources is due to corruption and the unequal distribution of wealth. Hammond (2011) on the other hand, argues that Angola's poor development could be attributed to the resource curse thesis developed by Auty (1995), arguing that high dependence on external rent leads to unsustainable development which fuels corruption. This argument can be countered however by pointing that several high oil producing countries such as Qatar perform well in the index. As such, rentierism should not be solely blamed for the country's development misfortunes, as other rentier states are well-

developed despite their high dependence on oil. Comparing the performance of Angola to a select sample highly developed countries of different geographic and culture characteristics, it becomes clear that these countries are highly developed due the low engagement of their formal and informal institutions in development hindering behavior, in particular the low engagement in public sector corruption (CPI), the high application of the rule of law, low levels of social dissension (SD), and the high levels of knowledge creation (KC).

It must be noted that the countries included in the proxy comparison exercise only represent 17% of the countries in the highly developed cluster, i.e., Cluster 4. As such, it would be unwise to assume that the aforementioned proxies are the sole drivers of socio-economic development. For example, there is a positive and high correlation between a countries level of corruption and political instability as exhibited by Figure no. 4. Such a significant relationship between political instability and corruption means that as one variable increase, so does the other. As such, similar to corruption, a country's level of political stability is an important variable to a country's level of socio-economic development. The question here is not whether political instability impacts socio-economic development, a position that is widely supported by literature, but to what extent does it impact development, and is it more important, for example, to socio-economic development relative to corruption.

5.4 Not all proxies are created equally

It must be stated that not all proxies are created equally. To elaborate, some proxies are more important than others to achieve high socio-economic development. Although one might argue that the results of the index are entirely dictated by weights, this is not entirely the case. To elaborate, a *correlation* analysis by summation is utilized to analyze the performance of the 10 countries that in accordance with their BBI rankings engage in the least levels of development hindering behavior, i.e., they are the 10 lowest ranking countries in the BBI (See Table no. 4). This technique involves summing the country ranks per proxy, i.e., *'$\sum Rank_{x,i}$'* where *'i'* represents the country and *'x'* represents the proxy, with the purpose of identifying the proxies with the least variability and highest consistency among the selected sample of countries. The results of this technique are presented in Table no. 9.

Table no. 9 – Result of Correlation Analysis by Summation

Proxy	Rank	$\sum$ Rank $_{x,i}$	Weight
CPI	1	69	11.5%
KC	2	71	5.0%
RL	3	78	7.6%
SD	4	86	3.2%
PI	5	90	11.5%
INFRA	6	97	7.4%
EF	7	103	11.4%
CLNW	8	122	5.1%
AML	9	149	3.7%
INF	10	191	5.0%
RENT	11	219	3.7%
SAV	12	249	4.9%
MM	13	254	7.4%
FLW	14	268	3.1%
UR	15	414	3.9%
SR	16	504	2.6%
CO2E	17	652	3.0%

It has become clear that the index weights do not entirely reflect the BBI rankings. For example, even though public sector corruption (CPI) has the highest weight in the index (11.5%), and it has the least variability among the other proxies meaning that it is the most important proxy for the socio-economic development of countries, the rest of the proxy rankings, i.e., Column 2, Table no. 9, are inconsistent with the index weights. For example, even though poor knowledge creation (KC) was assigned a weight of 5% utilizing the FAHP method, ranking 9th among 17 proxies according to both the FAHP weights and the expert weights, according to the BBI rankings of the 10 most highly developed countries and the correlation analysis by summation, it is the 2nd most important variable for socio-economic development. The importance of knowledge creation to socio-economic development is in-line with Romer's (1994) endogenous growth theory, which states that growth comes from within by investing in human capital. Another proxy which has been assigned lower weights but has a significant impact on the BBI rankings of the highly developed countries is the proxy of social dissension (SD) which is a measure of the absence of social cohesion. According to the correlation analysis by summation, and despite being ranked 14th among the 17 BBI proxies by both the FAHP and the expert weights, it is the 4th most important variable for socio-economic development. This finding is in accordance with the views of both Weber (1958) and Ibn Khaldūn (1967) who posit that societies who are highly connected, cohesive, and collaborative are highly developed societies. In summary, the results of the correlation by summation presented in Table no. 9 not only highlight the most important variables for socio-economic development, but they also show that not all proxies are created equally, even in the presence of weights which could favor one proxy over another.

5.5 Comparing BBI results with & without FAHP method: Is the use of FAHP justified?

The use of correlation by summation analysis and ranking proxies based on their perceived importance raises questions about the justification for integrating the FAHP method with expert weights to produce interval weights. The BBI results when expert weights were solely used in the aggregation process are presented in Table no. 10. A comparison and analysis of the BBI results with and without the application of the FAHP method could inform whether the use of the FAHP method is justified and whether the weights should be re-evaluated and the index re-aggregated.

Comparing the BBI results with and without the application of the FAHP method, i.e., expert weights were taken as is, shows very different results which are farther from reality. For example, viewing the results of the BBI given expert weights (Table no. 10), a highly developed nation such as Norway is now characterized as a developing country according to the expert weights, i.e., ranks 37th on the BBI. The same can be said for various countries such as Australia (36), Qatar (23), and Kuwait (13), the latter now being classified as an underdeveloped nation whereas under the BBI rankings with the FAHP method applied it was considered a developed nation. The aforementioned countries, and many others, are now assumed to be engaging in high levels of bad behavior according to the expert weights, whereas under the interval weights, i.e., the normalized fuzzy weights, the assumption is quite the opposite.

Table no. 10 BBI results aggregated without applying the FAHP method

Rank	Country	Rank	Country	Rank	Country
1	Angola	**31**	India	**61**	Poland
2	Sierra Leone	**32**	Nicaragua	**62**	Morocco
3	Nigeria	**33**	Mexico	**63**	Turkey
4	Mozambique	**34**	Benin	**64**	United States
5	Azerbaijan	**35**	Indonesia	**65**	Sri Lanka
6	Algeria	**36**	Australia	**66**	Bulgaria
7	Kazakhstan	**37**	Norway	**67**	United Kingdom
8	Zambia	**38**	Bahrain	**68**	Czech Republic
9	Niger	**39**	Kenya	**69**	Hungary
10	Russia	**40**	Senegal	**70**	Jordan
11	Ghana	**41**	Paraguay	**71**	Slovakia
12	Uganda	**42**	Pakistan	**72**	Greece
13	Kuwait	**43**	Peru	**73**	Finland
14	Saudi Arabia	**44**	Chile	**74**	Denmark
15	Burkina Faso	**45**	Guatemala	**75**	Portugal
16	Ecuador	**46**	Honduras	**76**	South Korea
17	Egypt	**47**	Uruguay	**77**	Austria
18	Bolivia	**48**	Serbia	**78**	Sweden
19	Laos	**49**	Nepal	**79**	Panama
20	Brazil	**50**	China	**80**	Italy
21	Colombia	**51**	Canada	**81**	Netherlands
22	South Africa	**52**	Thailand	**82**	Japan
23	Qatar	**53**	Cambodia	**83**	Spain
24	United Arab Emirates	**54**	Costa Rica	**84**	Germany
25	Vietnam	**55**	Philippines	**85**	France
26	Ivory Coast	**56**	Botswana	**86**	Belgium
27	Ukraine	**57**	El Salvador	**87**	Ireland
28	Tunisia	**58**	New Zealand	**88**	Switzerland
29	Malaysia	**59**	Dominican Republic	**89**	Singapore
30	Tanzania	**60**	Romania		

In summary, the irrational rankings of the BBI under the expert weights provides justification for the application of the FAHP method. The reason for these irrational rankings could be justified by the limitations of expert opinion which are troubled by high levels of subjectivity, inconsistency, and uncertainty. The FAHP method however, although far from being flawless itself, reduces these limitations and tends to produce weights which are more valid and reliable, especially if they are subjected to further treatment to reduce skewness, i.e., interval weights.

5.6 Is the BBI a better measure of development than the HDI?

How do the BBI rankings compare to the HDI rankings? And why does this research posit that the BBI is a better measure of development? Regarding the former, one way to compare the results of the BBI to that of the HDI is to develop a simple Ordinary Least Squares (OLS) regression model and study the relationship between the two. An alternative method is to utilize the *Mean Absolute Difference* (MAD) which is a measure of variability in a dataset, particularly the average distance between each individual data point and the mean.

The advantage of MAD over OLS is that the latter is highly sensitive to outliers. Moreover, a simple model which only includes two variables, i.e., HDI rank and BBI rank, could lead to misleading interpretations due to the likely presence of heteroscedasticity. As such, the MAD approach is utilized instead where both the BBI and HDI ranks are normalized, i.e., the BBI ranks will be inverted (BBI^{-1}) whilst the HDI ranks will be normalized for n=89, to determine the variability and possible correlation between the datasets. Regarding the latter, the MAD can be utilized as an alternative to the Pearson correlation coefficient test to study similarities in the dataset (McGraw & Wong, 1994; Gorard, 2015). The advantage of MAD over the Pearson test is that the former can be utilized when the dataset has identical statistical values, i.e., mean, standard deviation, and variance. The results of the BBI and the HDI country rank comparison are presented in Table no. 11.

Table no. 11 – BBI vs. HDI Rankings (2019)

Country	HDI	[1]Adjusted HDI	[2]Inverse BBI	[3]Diff	[4]ABS	Country	HDI	[1]Adjusted HDI	[2]Inverse BBI	[3]Diff	[4]ABS
Algeria	91	55	73	-18	18	**Italy**	30	22	22	0	0
Angola	147	78	89	-11	11	**Ivory Coast**	161	83	72	11	11
Australia	8	6	18	-12	12	**Japan**	20	17	19	-2	2
Austria	18	16	12	4	4	**Jordan**	102	58	44	14	14
Azerbaijan	88	53	60	-7	7	**Kazakhstan**	51	34	67	-33	33
Bahrain	42	30	30	0	0	**Kenya**	142	75	78	-3	3
Belgium	14	12	13	-1	1	**Kuwait**	64	42	37	5	5
Benin	157	80	71	9	9	**Laos**	136	72	79	-7	7
Bolivia	108	61	76	-15	15	**Malaysia**	63	41	31	10	10
Botswana	100	57	43	14	14	**Mexico**	75	45	51	-6	6
Brazil	84	50	75	-25	25	**Morocco**	120	66	49	17	17
Bulgaria	56	38	36	2	2	**Mozambique**	180	86	86	0	0
Burkina Faso	181	87	81	6	6	**Nepal**	141	74	85	-11	11
Cambodia	143	76	62	14	14	**Netherlands**	9	7	6	1	1
Canada	16	14	23	-9	9	**New Zealand**	15	13	14	-1	1
Chile	43	31	32	-1	1	**Nicaragua**	127	69	84	-15	15
China	85	51	41	10	10	**Niger**	188	89	82	7	7
Colombia	83	49	56	-7	7	**Nigeria**	160	82	87	-5	5
Costa Rica	62	40	42	-2	2	**Norway**	1	1	10	-9	9
Czech Republic	27	21	17	4	4	**Pakistan**	153	79	74	5	5
Denmark	10	8	4	4	4	**Panama**	57	39	26	13	13
Dominican Republic	89	54	53	1	1	**Paraguay**	103	59	63	-4	4
Ecuador	86	52	54	-2	2	**Peru**	80	48	48	0	0
Egypt	116	64	55	9	9	**Philippines**	109	62	45	17	17
El Salvador	123	67	47	20	20	**Poland**	35	25	29	-4	4
Finland	11	9	8	1	1	**Portugal**	38	26	16	10	10
France	26	20	11	9	9	**Qatar**	45	32	20	12	12
Germany	6	4	5	-1	1	**Romania**	49	33	35	-2	2
Ghana	138	73	69	4	4	**Russia**	52	35	65	-30	30
Greece	32	24	33	-9	9	**Saudi Arabia**	41	29	38	-9	9
Guatemala	126	68	58	10	10	**Senegal**	167	85	61	24	24
Honduras	131	71	64	7	7	**Serbia**	65	43	57	-14	14
Hungary	40	28	25	3	3	**Sierra Leone**	182	88	88	0	0
India	130	70	66	4	4	**Singapore**	12	10	2	8	8
Indonesia	107	60	39	21	21	**Slovakia**	39	27	27	0	0
Ireland	2	2	7	-5	5	**South Africa**	114	63	59	4	4
						South Korea	24	18	28	-10	10
						Spain	25	19	15	4	4

Country	HDI	[1]Adjusted HDI	[2]Inverse BBI	[3]Diff	[4]ABS
Sri Lanka	72	44	52	-8	8
Sweden	7	5	3	2	2
Switzerland	3	3	1	2	2
Tanzania	162	84	68	16	16
Thailand	79	47	34	13	13
Tunisia	96	56	70	-14	14
Turkey	54	36	46	-10	10
Uganda	158	81	77	4	4
Ukraine	76	46	83	-37	37
United Arab Emirates	31	23	24	-1	1
United Kingdom	13	11	9	2	2
United States	17	15	21	-6	6
Uruguay	55	37	40	-3	3
Vietnam	117	65	50	15	15
Zambia	145	77	80	-3	3

Note: [1]Adjusted HDI = Normalized HDI for n=89; [2]Inverse BBI = Inverted BBI Rank; [3]Diff = Difference; [4]ABS = Absolute Difference.

The MAD, represented by the symbol *'Δ'*, can be computed by summing the results of the absolute difference of the BBI & HDI country ranks, i.e., *'∑ABS'*; (Column 6, Table no. 11). The MAD between the two indices returns a value of 8.36, which indicates there is an average difference of 8 *positions* in the country ranks. Another way to communicate this information is transform the MAD into a percentage and quantify the variability in the rankings. This involves finding the mean of the country ranks, i.e., *'$\bar{x}$'*, and dividing the MAD by the mean, i.e., *'$\Delta/\bar{x}$'*, to compute the *Mean Relative Difference* (MRD), which is a measure of the variability of the rankings presented in percentage form. Computing the MRD presents us with a value of 18.5%, which means that the variability between the BBI and HDI country rankings is 18.5%.

Regarding the argument that the BBI is a more accurate measure of development than the HDI, this is due to the holistic nature of the BBI where 17 proxies are utilized instead of three, as well as due to the high correlation between the HDI and the GNI per capita, i.e., one of the variables utilized in the aggregation of the HDI. Repeating the same exercise for the purpose of testing to what extent the HDI and GNI per capita are highly correlated, the MAD and MRD were calculated to compare the results of the BBI and the GNI. The results indicate that the HDI and GNI are highly correlated to the extent that the variability between the BBI and the HDI and the BBI and the GNI is almost identical, i.e., given *'$\bar{x}$'* (mean) = 45, *'Δ'* (MAD) = 8.2, the Mean Relative Difference (MRD, i.e., $\Delta/\bar{x}$) = 18.2%.

The above results not only highlight the variability between the BBI and the HDI and the BBI and the GNI per capita respectively, but how significant the correlation is between the HDI and the GNI per capita. Of course, a high correlation is expected given that the GNI is one of three dimensions included in the HDI. However, the results reaffirm that the HDI is more accurately a measure of economic well-being than a measure of development.

In conclusion, the HDI has gained popularity as a measure of development due to its simplicity and ease of calculation, but its limitations are clear as it fails to capture the multifaceted nature of development factors. The BBI, on the other hand, is based on a comprehensive framework of 8 dimensions and 17 proxies, all of which are supported by both theory and literature as being essential for development. This comprehensive framework allows for a more nuanced and accurate understanding of the various factors that contribute to development disparities across nations, making it a valuable alternative to the HDI.

5.7 Results Summary

The BBI ranks countries in descending order of highest to lowest levels of bad behavior. African countries top the BBI rankings which is a result of restricting economic freedoms, political instability, corruption, and the poor application of the rule of law. All in all however, analyzing the entire dataset informs us that corruption is the most detrimental variable for development, followed by poor knowledge creation, and the poor application of the rule of law. Clustering countries by level of development informs us that Norden countries engage in the least level of bad behavior, followed by Oceanic countries. In addition, most European countries appear to perform well in the index, particularly those who are OECD members. Conversely, African and South Asia countries, i.e., Azerbaijan, India, Kazakhstan, Nepal, Pakistan, & Sri Lanka, perform poorly in the index. According to the diagnostic tests, the BBI is robust and the results are valid and reliable. However, the BBI does appear to be highly sensitive to weights, which is why a thorough weighting procedure was utilized, and an analysis of the index results with and without this procedure justify the use of expert weights and the FAHP method. In conclusion, the BBI provides a reliable and valid assessment of a country's development status from a behavioral perspective. However, to mitigate the sensitivity to weights, it is essential to employ a thorough weighting procedure, such as the expert weighting system and the FAHP method.

6. DISCUSSION

6.1 Behavior & Development

The results of the BBI provide great insight into the relationship between behavior and development. Countries that rank highest on the index, i.e., engage in the highest levels of bad behavior, are also the worlds least developed countries. One possible explanation for these findings is that such countries have a higher prevalence of corruption, which hinders their ability to achieve socio-economic development. Corruption undermines the rule of law and creates an environment in which it is difficult for businesses to operate and for people to access basic services. The absence of a stable political environment, combined with low levels of social cohesion, can also contribute to these unfavorable conditions. In contrast, countries that rank lower in the index appear to have low levels of corruption and a stringent application of the rule of law which according to theory and literature, is one of the many reasons they are considered highly developed countries. In addition, such countries appear have strong social cohesion, which helps to create a stable and supportive environment for businesses and individuals. Additionally, such countries also appear to have high levels of knowledge creation, which can drive innovation and spur economic growth. In summary, the BBI ranks countries based on their level of development hindering behavior. The results indicate that countries engaging in the highest levels of such behavior are underdeveloped, while those exhibiting the lowest levels of development hindering behavior are more highly developed.

In summary, the BBI findings highlight the importance of reducing corruption, strengthening the rule of law, promoting social cohesion, and fostering knowledge creation for promoting socio-economic development. Further research is needed to fully understand the complex relationships between these variables and to identify effective strategies for promoting socio-economic development in different countries and regions.

6.2 Other Causes of Underdevelopment

The insights yielded by the BBI are significant in explaining the reasons behind varying levels of development across nations. However, given that the BBI is limited to 17 variables, not all possible reasons have been properly explored. In addition to their engagement in behavior which hinders development, a possible cause for the poor development of countries, and a valid reason why such countries lead the BBI rankings, is due to poor generation of wealth. To elaborate, a common theme among countries at the top and bottom of the BBI is the status of their economic well-being represented by GNI per capita, i.e., most of the countries at the lower spectrum of the BBI are also one of the world's wealthiest nations, whereas most of the countries ranking at the higher spectrum of the BBI tend to be one of the world's poorest countries.

Besides wealth status, one variable that is highly cited in literature as the culprit for the poor development is colonial rule. To elaborate, Ocheni and Nwankwo (2012) posit that the backwardness of African countries can be attributed to colonialism and imperialism. Moreover, they opine that the selfish and corrupt behavior of the leaders of African countries is a consequence of such rule. This position is endorsed by Ragab (1980) who argues that colonial rule has led to "stunted institutional development". That said, the comparison provided by Lange (2004) on the contrasting development status of Botswana and Namibia, both of which were under colonial rule, prove that there is a way to move forward from a colonial past. Botswana's high development status relative to its African neighbors can be attributed to proper management of its rentier resources, where reinvestment of external rents led to tripling the countries per capita wealth and national income (Lange, 2004). The lack of such proper management in Namibia led to its poor development relative to its neighbor. In summary, the example presented of Botswana should not take away from the well-documented adverse effects of colonialism and imperialism on the fortunes of poorly developed countries that have had a colonial past, i.e., African.

Another important variable which could explain the different development levels of countries is geographical location and climate. To elaborate, Krugman (1999) finds a strong relationship between income per capita and Western European conditions, i.e., "temperate climate, absence of malaria, much of the population close to the coast or navigable rivers". Gallup *et al.* (1999) support this position opining that "location and climate have large effects on income levels and income growth through their effects on transport costs, disease burdens, and agricultural productivity, among other channels". The argument that development favors specific climate conditions is valid, as prosperous ancient civilizations were located near rivers and coasts. Moreover, geography and climate do not only impact the viability of a civilization, but it can also impact behavior as opined by Ibn Khaldun (2004). As such, favorable geographic locations and climate are indeed important for achieving high levels of development, however, this does not necessarily mean it is not possible to achieve such levels without favorable conditions. Botswana for example suffers from water scarcity due to lack of rainfall, whilst Singapore's lack of natural water sources has led to water shortages in the past. In short, even though geographic location and climate are favorable for development, it is still possible to achieve high levels of development in their absence.

To conclude, several factors may explain the differences in development across nations, some of which were not investigated in this study. For instance, factors such as cultural and religious fractionalization (Alesina *et al.*, 2003), collectivist versus individualistic societies

(Greif, 1994), illegitimate leadership (Chapra, 2008), and low levels of democracy (Olson, 1993) have also been identified as potential impediments to development. Nevertheless, this study focused on 17 proxies to develop a composite measure of bad behavior and found that corruption and corrupt behavior are the most significant impediments of development. That said, this does not take away from the validity of other hypotheses and variables as to why some nations are underdeveloped, as many factors could converge and lead to the poor development of nations. It does appear however that corruption has the most significant impact relative to these other variables – as supported by theory, literature, and the BBI findings.

6.3 Study Limitations

This research shares several limitations with studies which seek to introduce a composite index. To elaborate, since this study utilizes secondary data for the construction of the index, the proxies are limited by data availability. For example, the economic dimension of the BBI, although excludes GNI per capita, carries the highest weights. This can be explained by how most theory and literature focus on economic well-being as the primary driver of development, as well as how economic variables are easier to quantify than social, political etc. Moreover, the proxies might not truly represent the measures the researcher is attempting to quantify, which leads to the use of proxies which serve as similar alternatives. Also, some of the proxies are highly correlated, which could lead to double-counting. Furthermore, the study utilizes expert opinion in developing the index weights which are characterized by subjectivity, uncertainty, and consistency. In addition, the weights themselves are highly influential to the results of the index according to the sensitivity analysis. Another limitation of composite indices is that they often do not consider contextual factors such as historical, political, and cultural differences between countries. This can result in misleading or inaccurate comparisons. Moreover, composite indices often treat countries as homogeneous entities, ignoring internal heterogeneity and regional disparities. Overall, it is important to be mindful of these limitations when utilizing composite indices and to approach their results with a critical eye.

This research has attempted to address many of these limitations by: 1) including evidence from literature to justify the selection of the proxies; 2) improving upon the expert weights by integrating them with the FAHP method; 3) conducting uncertainty analysis which indicated that the index produces consistent outcomes; 4) arguing that highly correlation between the proxies is not always justified, as some of the correlation could be the result of a false-positive; 5) provide descriptive explanations as to why some countries are underdeveloped by discussing variables which have not been included in the index, i.e., fractionalization, colonialization, geographic location etc.

Another limitation of this study pertains to the theoretical framework of the BBI. To elaborate, the synthesized framework which provides justification for measuring the bad behavior of individuals and institutions has not been tested or replicated, as such, the study suffers from theoretical infancy. This can raise questions about the effectiveness and accuracy of the proposed framework, limiting its utility and generalizability. Moreover, a new and novel framework may lack comparability with existing frameworks or models, making it challenging to compare results or outcomes. Despite the limitations, developing a new framework can be an important step towards advancing research and knowledge on the relationship between behavior and development. Future research can test the effectiveness and accuracy of the proposed framework and replicate the BBI findings to enhance its validity and reliability.

7. CONCLUSION

Various measures have attempted to quantify socio-economic development for the purpose of cross-country comparison and policy formulation and assessment. The most popular of these measures is the Human Development Index (HDI) which ranks countries by their ability to enhance their constituents' capabilities based on the country's performance in economic, education, and health dimensions. The HDI has been criticized for its simplified definition of development and its narrow focus on economic well-being as a measure of development. Moreover, the HDI does not provide one with sufficient information as to why some countries are more developed than others due to only accounting for three dimensions in its construction.

On that regard, several authors have attempted to answer this question hypothesizing that some countries are more developed than others due to high levels of economic freedom, low levels of corruption, stable political environment, investment in human capital and innovation, among others. The forestated hypotheses have been extensively studied, many of which have developed into theories. Nevertheless, the limitation of such hypotheses is how they focus on elements external to the self and disregard the culpability of individual and institutional behavior on the poor development of nations. The reason it is essential to study the culpability of behavior on development because it serves as a precursor to the presence or absence of economic freedoms, corruption, political instability etc. Moreover, being able to define what constitutes development hindering behavior, and subsequently developing a better understanding over time as to why some people engage in bad behavior, not only allows the decision makers to reprimand such behavior but deter it as well. To facilitate for such objective, it is essential to develop a robust and empirical framework which properly defines and quantifies bad behavior within the context of development.

Properly defining the theories and the phenomena being measured is the first step in developing an index according to the composite framework of this study. The theories utilized by this study to provide justification for measuring the behavior of individuals and institutions, as well as facilitate the proxy selection process, are the concepts of 'Mafsada', i.e., societal harm, in the Maqasid of Shariah theoretical framework, i.e., purpose of Islamic jurisprudence, and Adam Smith's 'Worthless Fellow' in the Theory of Moral Sentiments (TMS) theoretical framework, i.e., the man who engages in behavior which goes against the purpose of our creation, i.e., the happiness and well-being of mankind, to quantify the development hindering behavior of individuals and institutions. Moreover, this research is influenced by the holistic framework of Ibn Khaldun on the drivers of development, leading to a construction of an index which is multidimensional, consisting of variables which are supported by theory and literature as drivers of development, and a better representation of socio-economic development relative to the HDI.

Another advantage of the BBI over the HDI is regarding the weighting system of choice. Whereas the HDI utilizes equal weights, the BBI employs an expert weighting system which has been further enhanced by the application of the FAHP method, which itself has been normalized to reduce skewness.

The results of the index indicate that countries that engage in the highest levels of development hindering behavior, i.e., bad behavior, are African countries. On the other hand, countries that engage in the lowest level of bad behavior are Norden countries. Analyzing the results of the index reveal that the most important variables for achieving high levels of socio-

economic development are low levels of corruption, high knowledge creation, stringent application of the rule of law, high levels of social cohesion, and high levels of political stability.

The main limitations of the BBI, like most indices, pertain to the high sensitivity to weights, and data limitations which influence the proxy selection process. To address this limitation, future research must attempt to replicate the index using different weighting strategies and compare the outcomes, as well as refine the proxies selected either by finding alternatives from secondary sources, or by attempting to collect data from primary sources.

The significance of this study is twofold: 1) it focuses on the culpability of behavior on development, a hypothesis which has not been well studied; 2) it attempts to synthesize a theoretical framework which provides justification for measuring the behavior of individuals and institutions.

The academic contribution and practical application of this study is in: 1) its attempt to quantify the development hindering behavior of individuals and institutions; 2) the thorough weighting system, which integrates expert opinion and the FAHP method to arrive at the index weights, i.e., the interval weights, providing researchers with an index weighting process which is more valid and reliable than the current practice of selecting equal weights; 3) the presentation of the BBI results in the form of groups and clusters, which provides higher benefit to researchers than absolute ranks as they facilitate for a better understanding as to why some countries are more developed than others, as well as providing policy makers with benchmarks and development levels to aim for; 4) the holistic nature of the index which is represented by the inclusion of 17 socio-economic variables pertaining to 8 different dimensions; 5) the application of the correlation by summation technique to identify the most important variables to achieve high levels of socio-economic development.

In closing, the ultimate goal of this study is to generate greater interest and discourse on the importance of behavior on development, and how to quantify such behavior. Future research should focus on better developing the theoretical framework, utilize primary data instead of secondary data, and attempt to replicate the study using different composite frameworks and methods.

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ANNEX

Table A-1 Supporting theories & literature for selecting the BBI proxies

IV	Supporting Theory/Lit	Findings
1	Scully (1992)	"Regarding economic, civil, and political freedom, relatively free countries are found to grow at three times the rate and are two and one-half times as efficient economically in transforming inputs into national output as countries in which freedom is relatively absent".
	Doucouliagos and Ulubasoglu (2006)	"Literature on the impact of economic freedom on economic growth and find an overall positive direct association between economic freedom and economic growth".
	Williamson and Mathers (2011)	"Economic freedom is more important than culture for growth outcomes, suggesting substitutability between the two. We posit that culture is important for growth when economic freedom is absent, diminishing in significance once economic freedom is established".
	Piątek *et al.* (2013)	"Economic freedom has a positive and significant contribution to economic growth on average both in transition and developed countries".
	Hussain and Haque (2016)	"Find strong evidence in support of a positive association between the growth rate (measured alternately with annual growth rate and five-year growth rate) and the economic freedom index".
	Brkić *et al.* (2020)	"Increases in economic freedom are related to economic growth".
	Gezer (2020)	"Economic freedom has an effect on development both in short and long run for the selected period".
2	Bae *et al.* (2021)	"Concentrated stock markets dominated by a small number of very successful firms are associated with less efficient capital allocation, sluggish initial public offering and innovation activity, and slower economic growth. "
3	Sachs and Warner (2001)	The Resource Curse Thesis (Auty, 1995) - "Countries with great natural resource wealth tend nevertheless to grow more slowly than resource-poor countries".
4	Kukaj (2018)	"Unemployment has a negative impact on the economic growth".
	Priambodo (2021)	"Unemployment and poverty negatively affect economic growth and HDI".
5	Misztal (2011)	"Increased savings may stimulate economic growth through increased investment (Bebczuk, 2000). This approach is supported by Harrod (1939), Domar (1946) and Solow (1956) growth models".
	Krieckhaus (2002)	"Public savings do matter for growth outcomes".
6	Akinsola and Odhiambo (2017)	"Inflation impacts economic growth in terms of specific thresholds (Bruno & Easterly, 1998; Vinayagathasan, 2013; Aydın *et al.*, 2016)".
	Yolanda (2017)	"Inflation on HDI is significant and positive; and Inflation on poverty is significant and positive".
7	Kusharjanto and Kim (2011)	"Improving infrastructure significantly enhances human development".
	Palei (2015)	"National competitiveness is influenced basically by the level of institutional development and other seven factors, including infrastructure, in turn infrastructure factor is determined mainly by the quality of roads, railroad infrastructure, air transport and electricity supply".
	Mohanty *et al.* (2016)	"The study establishes close linkage between infrastructure and human development".
	Apurv and Uzma (2021)	"Infrastructure enhances trade, export, foreign direct investment, and economic growth".
8	Argentiero *et al.* (2008)	"Money laundering is more volatile than aggregate GDP and it is negatively correlated with it".
	Kumar (2012)	"Money laundering has significant negative impacts on the development of a country"; as cited by Loayza *et al.* (2019).
	Hetemi *et al.* (2018)	"Money laundering has a significant and negative effect on economic growth".
	Šikman and Grujić (2021)	"There is a relation of the Anti-Money Laundering Index (AMLI) on GDP, financial market development and the HDI".
9	Mo (2001)	"1% of increase in estimated corruption level produces decrease of economy growth by 0.72%".
	Akçay (2006)	"Corruption is responsible for low economic growth, less foreign and domestic investment, high inflation, currency depreciation, low expenditures for education and health, high military expenditures, high income inequality and poverty, less tax revenue, and high child and infant mortality rates".
	Popova and Podolyakina (2014)	"The majority of researchers suppose corruption to cause immense problems to economy and society".

IV	Supporting Theory/Lit	Findings
10	Absalyamova *et al.* (2016)	"An increase in the corruption of the socio-economic system of the state by 1% caused the HCSDI (Human Capital Sustainable Development Index) to reduce by more than 1%".
	Wahyudi and Alfian (2021)	"The lower corruption level in a country, the higher the development of the quality of human life."
	Alesina *et al.* (1996)	"Political instability reduces growth".
	Yamarik and Redmon (2017)	"Greater political instability and violence can lead to more corrupt behavior along the lines of Olson's (1993) roving bandit".
	Uddin *et al.* (2017)	"Political stability is pivotal for economic growth of developing countries. Political risk is found to have detrimental effect on economic growth. Development of economic institution in developing countries affects economic growth positively".
	Rodrik *et al.* (2004)	"Consider rule of law, geography (distance from the equator), openness to trade, and colonial history as potential determinants of economic growth. They find that only rule of law explains economic growth"; as cited by Bhagat and Hubbard (2022).
11	Rigobon and Rodrik (2005)	"Democracy and the rule of law are both good for economic performance, but that the latter has a much stronger impact on incomes".
	Luong *et al.* (2020)	"Ineffectiveness of governance and rule of law, could be the main reasons for taking part in the shadow economy".
12	Weber (1958)	The Protestant Ethic - Calvinists placed the well-being of the society, and the well-being of the 'culture' over the well-being of the family. This led to a highly connected and collaborative society which further promoted economic well-being.
	Ibn Khaldūn (1967)	Theory of Development - The factors which promote or hinder development are so multi-dimensional that they include culture as well.
	Fukuyama (2001)	"Social capital is an instantiated informal norm that promotes co-operation between individuals. In the economic sphere it reduces transaction costs and in the political sphere it promotes the kind of associational life which is necessary for the success of limited government and modern democracy".
	Iyer *et al.* (2005)	"Social capital is important for economic growth and regional development".
	Romer (1994)	Endogenous Growth Theory; Development and growth are achieved due to investment in human capital, innovation, and knowledge creation.
13	Solarin and Yen (2016)	"Research output has positive impact on economic growth, irrespective of whether the sample is for developing or developed countries".
	Pinto and Teixeira (2020)	"Research output positively and significantly impacts on economic growth et al".
14	Vilariño *et al.* (2017)	"FLW negatively affects the environment, accounting for 8 % of Greenhouse emissions. It also causes direct economic costs of USD 1 trillion/year. Decreasing FLW will contribute to reducing world hunger, improve food security, and ensuring food safety and nutrition".
15	Nawaz and Alvi (2017)	"The findings confirm the importance of availability of proper nutrition and clean water to the population at large to ensure sustainable economic growth and development".
	Kong *et al.* (2020)	"Access to improved water sources is a crucial factor for a country's sustainable growth and development".
16	Shepard *et al.* (2016)	"The national cost of suicides and suicide attempts in the United States in 2013 was $58.4 billion. Lost productivity (termed indirect costs) represents most (97.1%) of this cost".
	Kinchin and Doran (2017)	"Suicide and non-fatal suicide behavior (NFSB) are significant problems faced by most countries. The present value of the economic cost of suicide and NFSB is estimated at $6.73 billion".
17	Azam *et al.* (2016)	"The ultimate impact of shrinking pollution will help in supporting sustainable economic growth and maturation as well as largely improve society welfare".
	N'Zué (2018)	"There is a tipping point beyond which increment of CO2 emissions is detrimental to per capita GDP".

Table A-2 BBI Proxies and their corresponding Maqasid of Shariah

IV	IV1: Bad Economic Behavior	Maqasid
1	Restricting Economic Freedoms	Hafth Al Mal (Wealth)
2	Monopolistic Markets	Hafth Al Din (Religion); Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
3	Rentierism	Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
4	Unemployment	Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
5	Inflation	Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
6	Poor Savings	Hafth Al Mal (Wealth); Hafth Al Nasl (Family)
7	Poor Infrastructure	Hafth Al Mal (Wealth); Hafth Al Nasl (Family)
	IV2: Corruption	
8	Money Laundry	Hafth Al Din (Religion); Hafth Al Mal (Wealth)
9	Public Sector Corruption	Hafth Al Din (Religion); Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
	IV3: Bad Political Behavior	
10	Political Instability	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
	IV4: Poor Governance	
11	Poor Rule of Law	Hafth Al Din (Religion); Hafth Al Mal (Wealth); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
	IV5: Bad Societal Behavior	
12	Social Dissension	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
	IV6: Poor Knowledge Creation	
13	Poor Academic Influence	Hafth Al Din (Religion); Hafth Al Aql (Mind)
	IV7: Preserving Health	
14	Food Loss & Waste	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
15	Poor Access to Clean Water	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
16	Suicide Rates	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)
	IV8: High Environmental Footprint	
17	CO2 Emissions	Hafth Al Din (Religion); Hafth Al Nasl (Family); Hafth Al Nafs (Self)

Notes

[1] Main effects determine the impact of modifying a single input parameter while keeping all others constant, thus enabling the identification of the most influential input parameters, whereas interactions indicate the combined influence of two or more input parameters on the output, signifying the effect of adjusting several input parameters concurrently. The study's sensitivity analysis demonstrated that the BBI results are highly sensitive to weights, and the main effects are solely due to index weights. The effect of interactions between the parameters is negligible.