Chapter 1:

The role of composite indices in international economic diplomacy

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Synopsis As risks of all sorts, from economic and financial crises to terrorism acts and pandemics, keep on characterising and affecting all aspects of life globally, at the individual and societal level, national and international organisations, as well as governments, need to be constantly adapting and collaborating through international diplomacy to pursue common goals for people's well-being. This is where the topic of composite indices comes up. Composite indices are used by national and international organisations, and governments and businesses alike, to monitor different performance aspects of the economy of a country and the people therein; and they have historically been valuable as communication tools and as inputs into decision and policymaking. In this work, we delve into the relevant literature to explore the link between international diplomacy, institutions, and composite indices, with the aim to highlight the usefulness of composite indices in practice. We conclude with final thoughts and recommendations for future research on the topic.

1 International Economic Diplomacy

Diplomacy can be defined as "the conduct of international relations by negotiation and dialog or by any other means to promote peaceful relations among states. Besides this widely accepted single definition, diplomacy is also a set of practices, institutions, and discourses which is crucial for the basic understanding of the historical evolution of the international system and its evolving functional and normative needs" (Cornago, 2008, p. 574).

In the post-modern environment, the concept of 'diplomacy' has undergone substantial mutations. To begin with, the phenomenon of 'globalisation' has transformed international economic relationships around the world; then, a growing number of actors (state and non-state) have begun to emerge and impact such relationships, increasing interconnectivities and interdependencies. In turn, all of these have affected the economic, social, and political spheres of societies and citizens (Saner & Yiu, 2001).

Diplomacy, in its various forms, plays a vital role in international relationships. First, diplomacy provides the means for measuring international relations; and generally, such measurements involve comparisons across countries at the same point in time. Second, diplomacy is a veritable means for conflict resolution, peace-building in crisis situations among nations. Diplomacy facilitates information, communication, and knowledge exchange among nations.

In every-day language, diplomacy is most widely thought of from the perspective of the political aspect. However, this chapter (and entire book, for that matter), is not intended for covering the political aspect of diplomacy, which is nonetheless, an important dimension. Rather, the interest is to explore the more socio-economic dimension of diplomacy: how diplomacy can support country competitiveness, social progress, and people's well-being, as well as the stability and resilience in nations around the world through reliance on various composite indices.

2 Composite Indices

In recent years, there has been increased interest in studying (composite) indices for the betterment of the public. A recent special issue of the journal Socio-Economic Planning Sciences, edited by Charles, Emrouznejad, and Johnson (2020), stands as proof of this assertion. The special issue focused on the conceptualisation and development of new indices for the betterment of the public and novel algorithms and approaches that integrated or refined those indices, as well as novel ways of using the existing indices to improve the public policies that serve the greater good. The articles contained therein aimed to position themselves beyond purely

suggesting new/modern/revised indices with the economics view and conceivably validating them using real-life vital data sets; rather, the scope of the articles was to help policymakers gain an advanced understanding of the ways that would unleash greater long-term social success, as well as propose strategies that would create the conditions for the betterment of the public.

Composite indices are used by a range of governments, national and international organisations, as well as businesses to monitor different performance aspects of the economy of a country and the people therein. In a nutshell, composite indices are synthetic indices of individual indices which compare and rank entities (*e.g.*, countries, organisations, and so on) in different performance areas, such as competitiveness, innovation, gender equality, human development, governance, and environmental sustainability, just to name a few (n/a, 2003). Composite indices can surmount national particularities and bring the consideration to a common denominator (Tangian, 2004).

Munda and Nardo (2003, p. 2) noted that:
Composite indicators stem from the need to rank countries and benchmarking their performance whenever a country does not perform strictly better than another. Composite indicators are very common in fields such as economic and business statistics (e.g., the OECD Composite Leading Indicators) and are used in a variety of policy domains such as industrial competitiveness, sustainable development, quality of life assessment, globalization and innovation (see Cox and others 1992, Huggins 2003, Wilson and Jones 2002, Guerard 2001, Färe et al. 1994, Lovell et al. 1995, Griliches 1990 and Saisana and Tarantola 2002, among others)... A general objective of most of these indicators is the ranking of countries according to some aggregated dimensions (see Cherchye 2001 and Kleinknecht 2002).

Of course, it is always a challenge to reduce complex socio-economic phenomena to a single index; so, it is important to remember that composite indices are limited in that way, reflecting only a simplified version of reality. As emphasised by the OECD (2003, p. 3), "composite indicators are valued for their ability to integrate large amounts of information into easily understood formats for a general audience... Despite their many deficiencies, composite indicators will continue to be developed due to their usefulness…". So, we must also acknowledge that being developed in this way is useful in a very practical sense, in that they can better focus and direct policy debates. Needless to say, then, that historically composite indices have been valuable as communication tools and as inputs into decision and policy-making.

2.1 Pros and cons of composite indices

The number of composite indices that are constructed and used nationally and internationally is growing very fast; it is, therefore, necessary to understand their benefits and limitations. In their technical report on tools for composite indicators building, Nardo, Saisana, Saltelli, and Tarantola (2005, p. 6) elegantly summarised the pros and cons of composite indices, which are conveyed here in Table 1.

Table 1

Pros and Cons of Composite Indices

Pros of composite indices	Cons of composite indices
Summarise complex or multi-dimensional issues, in view of supporting decision-makers.	May send misleading policy messages, if they are poorly constructed or misinterpreted.
Are easier to interpret than trying to find a trend in many separate indicators.	May invite drawing simplistic policy conclusions, if not used in combination with the indicators.
Facilitate the task of ranking countries on complex issues in a benchmarking exercise.	May lend themselves to instrumental use (*e.g.*, be built to support the desired policy), if the various stages (*e.g.*, selection of indicators, choice of model, weights) are not transparent and based on sound statistical or conceptual principles.
Assess progress of countries over time on complex issues.	The selection of indicators and weights could be the target of political challenge.
Reduce the size of a set of indicators or include more information within the existing size limit.	May disguise serious failings in some dimensions of the phenomenon, and thus increase the difficulty in identifying the proper remedial action.
Place issues of countries performance and progress at the centre of the policy arena.	May lead wrong policies, if dimensions of performance that are difficult to measure are ignored.
Facilitate communication with ordinary citizens and promote accountability.	

Source: Taken from Nardo, Saisana, Saltelli, and Tarantola (2005, p. 6).

2.2 Characteristics of good composite indices

There are a number of general characteristics that indicators should have in order to be both useful and efficient. Although not constituting a comprehensive list, the following are examples of guidelines or best practices (of a theoretical, technical, or procedural nature) most commonly invoked; in this sense, indicators should be:

Clearly defined

Indicators should have clear and intelligible definitions. In this sense, the intended users of the indicators should be able to understand them even if the definitions contain technical terms. At the same time, another aspect that needs to be considered is that narrowing or broadening too much the definition of an indicator can also create problems; hence, finding the right balance is an art.

Theoretically sound

This aspect is many times underlooked; however, it is important that the composite index has a strong theoretical foundation. This means that the various variables, pillars, and/or subpillars, and factors composing the index should be informed by relevant theoretical and policy underpinning. Moreover, such consideration will also be useful in further decisions related to the weighting mechanism to be used; for example, variables with greater relevance or importance to the phenomenon being analysed should be given a greater weight. Of course, weights may be assigned both qualitatively (*e.g.*, through expert opinion) and quantitatively (*e.g.*, through techniques such as principal component analysis or factor analysis).

Relevant

The variables, pillars, and/or subpillars, and factors composing the index should not only be analytically sound but should further be relevant to the phenomenon being measured. There should also be a clear articulation of the stakeholders to whom indicators will be useful. Differences in interests and perspectives will make an indicator more relevant to some users and less to others. As such, indicators need to be aligned with the strategic goals and objectives of the organisations that intend to use them.

Comparable

Variables come in a variety of statistical units with different ranges or scales; hence, variables should undergo standardisation or normalisation to bring them to a common basis that in turn will render them comparable. Furthermore, the indicators should ideally be able to be compared with a consistent database, both between organisations and with historical values. Additionally, a vital element around comparability involves the consideration of the context and the conditions therein, which if highly different across contexts, might render the comparison invalid.

Verifiable

Statistical validation is another criterion to be considered. First, indicators must be collected and calculated in a way that allows the data and results to be verified (thus, ensuring transparency and accessibility); in other words, relevant parties should be in a position to verify the accuracy of the information included, the consistency of the methods used, and the robustness of the composite index developed. Second, methodological practicalities need to be acknowledged and clearly stated: for example, how are missing values being dealt with, whether there are any issues regarding the double-counting of phenomena, how the qualitative data are being integrated into the index, and so on. Third, sensitivity tests should be conducted to assess the impact of including or excluding variables, changing weights, and using different standardisation or normalisation techniques, among others.

Flexible

Indicators should be adaptable to changes that may occur both nationally and internationally. In this sense, indicators should be able to accommodate new variables or methods of computation, encouraging innovation.

Placed in time

Indicators should be based on data that are available within a reasonable period of time, depending on how and when the information is used. Some data are collected daily or weekly, while other data are only available once a year and across years.

Visually sound

Lastly, it is important to remember that visualisation matters, mostly because it can be deceptive. As it is well known, the same information can be presented in very different ways, leading to different interpretations; some of the most common misleading visualisation techniques involve cherry picking, omitting the baseline, manipulating the axes, using wrong graphs, overloading or underloading with data, and so on. Considering that composite indices have the power to influence the policy message, the presentation of the results of composite indices should be carefully considered so as to acknowledge their limitations, and possibly show the results and impact of the sensitivity tests results.

3 Governments and International Organisations

One of the roles of both national and international organisations (such as the United Nations, The Organisation for Economic Co-operation and Development - OECD, World Economic Forum - WEF, International Institute for Management - IMD, Social Progress Imperative, etc.) is to assist governments in their efforts to design and implement better policies for better development on a national and

global scale. Thus, the role that the composite indices developed by these organisations have for diplomacy as a policy advisor to foster progress it its various forms is more than evident. "A significant and growing number of international business and policy decisions directly rely on such indicators. A growing amount of analysis that influences broader perceptions, and often directly or indirectly shapes future decisions, does likewise" (OECD, 2006, p. 13).

As risks (be them economic or financial crises, terrorism acts, or pandemics, just to name a few) keep on characterising and affecting all aspects of life globally, at the individual and societal level, governments need to be constantly adapting and collaborating through international diplomacy to pursue common goals for people's well-being (such as increasing economic growth, decreasing inequalities, and enforcing environmental regulations). True well-being means a achieving a balance between various development goals, such as economic, social, and environmental. In this sense, it is worth pointing out the 17 global Sustainable Development Goals (SDGs) adopted by the United Nations in 2015, aimed at achieving a better and more sustainable future by 2030. The 17 SDGs are:

(1) No Poverty;
(2) Zero Hunger;
(3) Good Health and Well-being;
(4) Quality Education;
(5) Gender Equality;
(6) Clean Water and Sanitation;
(7) Affordable and Clean Energy;
(8) Decent Work and Economic Growth;
(9) Industry, Innovation, and Infrastructure;
(10) Reducing Inequality;
(11) Sustainable Cities and Communities;
(12) Responsible Consumption and Production;
(13) Climate Action;
(14) Life Below Water;
(15) Life On Land;
(16) Peace, Justice, and Strong Institutions;
(17) Partnerships for the Goals.

Each goal typically has 8-12 targets, and each target has between 1 and 4 indices used to measure progress toward reaching the targets. In total, the initiative started with 169 targets and 232 indices. In time, because of measurement difficulties (Winfried, 2021), revisions have been made; for example, in 2020, 36 changes to the global index framework were proposed, with some indices being replaced or revised, while others deleted (United Nations, 2020).

All in all, the document that contains these goals, titled 'Transforming Our World: The 2030 Agenda for Sustainable Development', represents a commitment

of heads of state and government to eradicate poverty and achieve sustainable development by 2030 worldwide. Importantly, this document also differentiates between gross domestic product (GDP) and social progress when it formulated its objective as: "By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries" (Charles & D'Alessio, 2019). And this is a critical observation because "'The Beyond GDP' initiative has brought together a large number of countries who found themselves cooperating in developing indicators that are as clear as the GDP, but more inclusive of environmental and social aspects of progress" (Charles, Gherman, & Tsolas, 2020, p. 160).

3 Methodological and Computational Aspects

As previously mentioned, composite indices represent a useful tool for policy-making and public communications. However, the process of creating a composite index is not simple, and the methodological and computational aspects present a number of technical issues that, if not addressed properly, can lead to composite indices being misread or manipulated. Of course, views differ quite widely. For example, back in 2004, Sharpe (2004) noted that:

> *The aggregators believe there are two major reasons that there is value in combining indicators in some manner to produce a bottom line. They believe that such a summary statistic can indeed capture reality and is meaningful, and that stressing the bottom line is extremely useful in garnering media interest and hence the attention of policy makers. The second school, the non-aggregators, believe one should stop once an appropriate set of indicators has been created and not go the further step of producing a composite index. Their key objection to aggregation is what they see as the arbitrary nature of the weighting process by which the variables are combined.*

So, it is equally difficult to know where to start and when to stop. Despite the existence of so many indices, there is no single methodology for the computation of any of them. There is no general agreement on the existence of a set of standardised or holistic indices to measure progress in its various forms. Some indices may lack a certain level of transparency, while others may suffer from bias, and others may not be applicable to developed and developing countries in the same way. Needless to say, this is not just a problem of the past or the present, but also of the future; the perfect index will undoubtedly never exist. Nevertheless, indices are needed to monitor conditions and assess prospects for future developments in countries around the world in terms of political stability, social progress, poverty reduction, gender equality, human rights and human development, and so on. So, efforts can be made to periodically renew interest in composite indices and reiterate the need to revise them, developing improved ones that can better serve the objectives

for which they were created in the first place. Below, we discuss two directions that such studies have generally taken.

The first group of studies seek to make changes at the conceptual level. For example, Coronado, Charles, and Dwyer (2017) computed a regional competitiveness index by taking agricultural resources as determinant factors, which represents a novel conceptualisation of the regional competitiveness index. In this sense, the authors identified regional factors related to the use of water, soil, production, revenues, and rural population, which conform a total of six productivity indices, that the authors then employed to calculate the regional agricultural competitiveness index.

The second group of studies acknowledge that changes are needed not just at the conceptual level, but also at the methodological level. For example, take the case of the computation of regional competitiveness. Charles and Diaz (2016), Charles and Sei (2019), and Charles and Zegarra (2014) observed that generally, the existing methodologies to compute a regional competitiveness index use the information of several variables to measure the performance across a specific number of dimensions, or pillars, that are considered to be the fundamental components of competitiveness. Now, taking these pillars as the inputs for computations, the computations follow a non-optimisation approach most of the times, where the indices are derived in an absolute sense, and the pillars are given equal importance in terms of weights. But, as the authors noted, "this approach raises two concerns, which have been treated in the literature of composite indicators (Cherchye *et al.*, 2007), namely that: (1) the indices are absolute, so then the results are sensitive to the units of measurement of the pillars, and (2) some value judgements are implicit in the choice of weights (in this case, pillars may not play an equal role in the competitiveness of every region)" (Charles & Diaz, 2016). The studies mentioned above attempted to address such shortcomings by proposing envelopment-based models.

Similarly, using the theoretical framework of the World Bank, Charles (2015) developed a novel methodology based on data envelopment analysis to compute a doing business index that could more accurately capture the efficiency of the business climate of 189 countries. The objective was to rank the economies according to the outcomes achieved in the various factors. But in contrast with the methodology employed by the World Bank (which is an equal weight methodology, where each variable has the same weight in each of the 10 factors and each factor has the same weight in the global index), a data envelopment analysis approach does not impose ad-hoc weights. In the author's words, "the reasoning behind is the following: with multiple outcomes to evaluate, different weights could produce different orderings in the ranking; furthermore, imposing the same weights for every economy could fail to reflect their individual preferences or constraints" (Charles, 2015, p. 15). The proposed methodology overcomes all of these barriers. Moreover, the model is both unit invariant and translation invariant.

More recently, Charles, Gherman, and Tsolas (2020) showed a novel way to compute a regional social progress index, under a two-phase approach. Building upon the framework provided by the Social Progress Imperative (2016), in the first phase, the authors aggregated the item-level information into subfactor-level indices and the subfactor level indices into a factor-level index using an objective general index (Sei, 2016); in the second phase, they use the factor-level indices to obtain the regional social progress index through a pure data envelopment analysis approach.

The nicety of these recent methodological developments is that they can be used for the computation of various other indices. For example, the proposed model by Charles and Diaz (2016) does not only serve to compute the index of regional competitiveness, but it can also be used to construct other index systems, such as the Social Progress Index, Doing Business Index, Happiness Index, Innovation Index, and so on.

At this point, it is also important to acknowledge that there is a third strand of research, an emergent and promising one, that advocates for changes that go beyond conceptual and methodological aspects, emphasising a need for more collaborative, inter- and intra-disciplinary efforts. This is because, in the context of the ever-changing conditions in the world economy, we require a much broader set of indicators to examine and monitor performance and progress towards achieving the intended aims and determine where resources and support are needed. This also means higher level of cooperation, with all stakeholders involved.

We join all these calls; more specifically, we join the calls for the development of improved conceptual frameworks and methodologies to measure the various dimensions of progress and people's well-being, as well as we join the calls for a more efficient social and civil dialogue between various interested groups (Charles, Gherman, & Paliza, 2019). These new and revised indices can further be utilised by international diplomacy to promote international consensus and reach new milestones in terms of economic, social, and environmental agreements. International economic diplomacy requires indices that allow the design and implementation of relevant policies at both national and international levels. Hence, indices can be used by policymakers and other interested parties to monitor different performance aspects of the economy of a country and the people therein.

3 Final Thoughts

Composite indices are useful for monitoring different performance aspects of the economy of a country and the people therein; and they have historically been valuable as communication tools and as inputs into decision and policymaking. How-

ever, the process of creating a composite index is not simple, and the methodological and computational aspects present a number of technical issues that, if not addressed properly, can lead to composite indices being misread or manipulated. Over time, indices have been met with various criticism, among which, the fact that they may be biased or may lack theoretical support, transparency, or operational rules. Despite the existence of so many indices, there is no single methodology for the computation of any of them. So, it comes as no surprise that there is no general agreement on the existence of a set of standardised or holistic indices to measure progress in its various forms. Yet, composite indices are increasingly being used by governments, national and international organisations, and businesses alike, for cross-country comparisons. As Saisana *et al*. (2005) pointed out:

> *"[...] it is hard to imagine that debate on the use of composite indicators will ever be settled [...] official statisticians may tend to resent composite indicators, whereby a lot of work in data collection and editing is "wasted" or "hidden" behind a single number of dubious significance. On the other hand, the temptation of stakeholders and practitioners to summarise complex and sometime elusive processes (e.g. sustainability, single market policy, etc.) into a single figure to benchmark country performance for policy consumption seems likewise irresistible."*

So, it is fair to say that indices will always be among us. Considering the importance of composite indices for monitoring and benchmarking the mutual and relative progress of countries in a variety of policy areas, improvements in the way indices are constructed and used are a very important research issue from a theoretical, methodological, and practical point of view (Munda & Nardo, 2003).

Our aim in this manuscript has been to renew interest in composite indices and highlight the need to periodically revisit them, in an attempt to develop improved ones that can better serve the objectives for which they were created in the first place, helping to guide and move the field and practice forward. From a very practical perspective, there is a need for indices that can accommodate the new challenges in a world impacted not only by the characteristics of today's business environment [i.e., volatility, uncertainty, complexity, and ambiguity – or VUCA], but also by the characteristics of the big data age [among which we mention context, complexity, and connectedness – see Charles and Gherman (2013)], of course, within an ethical framework (Charles, Tavana, & Gherman, 2015).

As Charles, Emrouznejad, and Gherman (2021) noted, "the relatively recent phenomenon posed by the exponential growth of big data has brought with it new challenges, one of the most intriguing of which deals with knowledge discovery and large-scale data-mining (Emrouznejad & Marra, 2016). The presence of big data has been 'pushing' organisations [N.B. of all sorts, we may add] to review their

practices and identify opportunities that would allow them to base a substantial portion of their operational decisions on data, otherwise known as data-driven decision-making (Charles *et al.*, 2020)."

Studies aimed at bringing together the topic of composite indices and large/big data have started emerging and, without a doubt, represent one of the future directions of research. For example, Resce and Maynard (2018) aggregated millions of tweets and proposed a composite Better Life Index (BLI) based on the weighted average of the national performances in each dimension of the BLI, using the relative importance that the topics have on Twitter as weights. The idea is novel not only methodologically, but also conceptually, since this exercise develops a composite index that considers social priorities in the aggregation. Indeed, different computational approaches and different data collection methods will yield different insights. So, another implication is that there is a need for more cross- and interdisciplinary empirically grounded research, more specifically, for new research approaches to study people and practice in truly insightful and impactful ways [for an example, please see Charles and Gherman (2018); Gherman (2018)], which can then translate into the creation of better, more comprehensive composite indices.

The development of such indices will further require a greater level of collaboration between a wider range of stakeholders, from researchers to data scientists, regulators and policymakers, business executives and members of civil societies, just to name a few. This is because while traditionally, diplomacy has been the prerogative of ambassadors and official envoys, today, the management of international economic relations is no longer confined to the state, but rather extended to civil and commercial affairs (Saner & Yiu, 2001). In a nutshell, therefore, there is a need to create an extended network of experts who can engage in constructive policy dialogue. Part of such dialogue would encompass not only efforts to construct better composite indices, but also to develop quality guidelines for the construction of such indices, with clear policy implications.

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