PATHWAYS FOR ADAPTING THE SUSTAINABLE DEVELOPMENT GOALS TO THE NATIONAL CONTEXT: THE CASE OF PAKISTAN

Jaebeum Cho, Alberto Isgut and Yusuke Tateno*

Because of the ambition, comprehensiveness and complexity of the 17 goals and 169 targets of the 2030 Agenda for Sustainable Development, the implementation of it is very difficult, especially for developing countries such as Pakistan. The present paper introduces an analytical framework based on a subset of the Global SDG Indicators Database to identify an optimal pathway for the implementation of the 2030 Agenda in Pakistan. The analysis suggests that the optimal pathway would enable the country to progress towards higher income levels and human development. It also suggests that the country's national development plan, Vision 2025, is expected to contribute towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner.

JEL classification: O10, O21, C60.

Keywords: Sustainable Development Goals, national planning, network analysis, method of reflections.

I. INTRODUCTION

The 2030 Agenda for Sustainable Development, adopted by more than 150 world leaders on 25 September 2015, is an ambitious agenda of unprecedented scope and significance. Its 17 goals and 169 associated targets are aimed at ending poverty and hunger, protecting the planet from degradation, ensuring that all human

beings can enjoy prosperous and fulfilling lives, and fostering peaceful, just and inclusive societies. Recognizing that countries are characterized by different levels of development and capacities, the agenda states that each government will decide how its aspirational and global targets should be incorporated in their national planning process, policies and strategies. This flexibility, while highly desirable, leads to the question of what is the best way for countries to adapt the 2030 Agenda to their unique circumstances. The objective of the present paper is to provide an answer to this difficult question.

To provide an answer, this paper starts from the premise that the Sustainable Development Goals comprise a complex system. A complex system is in essence a nexus of diverse, multiple and interconnected elements in which the whole is not necessarily equal to the sum of its parts. This view of the Goals – or any other set of relevant global issues for that matter – is not new. At the United Nations Conference on Human Environment, later called the Stockholm Conference, in 1972, the former Prime Minister of India, Indira Gandhi advocated such a view: "The population explosion, poverty; ignorance and disease, the pollution of our surroundings, the stockpiling of nuclear weapons and biological and chemical agents of destruction are all parts of a vicious circle. Each is important and urgent but dealing with them one by one would be wasted effort" (United Nations, 2015). A similar integrated view provided the basis for the 27 Rio Principles agreed at the United Nations Conference on Environment and Development, or the Earth Summit, in 1992, and was reconfirmed for the United Nations Conference on Sustainable Development, commonly known as Rio+20.

The analytical approach for this paper is based on the assumption that all goals and associated targets in the 2030 Agenda are, to a greater or lesser extent, interdependent. For example, eradicating poverty (Sustainable Development Goal 1) and promoting healthy lives (Sustainable Development Goal 3) are closely linked with each other, and cannot be viewed separately as individual targets. Such interdependencies need to be taken into account when considering alternative paths for the implementation of the Goals because achieving one goal will help in achieving other closely linked goals. In addition, the lack of attainment of some goals may create bottlenecks for attaining other goals, and such obstacles need to be considered in national frameworks for the implementation of 2030 Agenda.

To capture such interdependencies and bottlenecks, the present paper conceptualizes the Sustainable Development Goals as a system represented by a network of 75 indicators, selected from the Global SDG Indicators Database, and 170 countries. This system is referred to hereafter as the SDG system. The paper also computes a country-specific measure, termed SDG capacity, which quantifies the

capacity of each country to implement the Goals, and it proposes optimal strategies of implementation of the Goals, including specific recommendations for their prioritization and sequencing, for the case of Pakistan.[1] While the focus of the paper is on the attainment of the Goals in Pakistan, also considered is the attainment of the goals of the Pakistan national development plan, Vision 2025. The analysis used in this paper is complementary to previous work on the interlinkages between the Sustainable Development Goals.[2]

The rest of the paper is organized as follows. Section II contains a description of the data set employed for the analysis and a review of the degree of attainment of the Sustainable Development Goals in Pakistan. Section III includes a description of the SDG system from the perspective of Pakistan. In section IV, the implementation capacity of Pakistan with regard to the 2030 Agenda is discussed, and in section V optimal pathways for progress in Pakistan are reviewed. Section VI consists of an analysis of the scenarios comparing the optimal implementation of the 2030 Agenda and Vision 2025, and section VII concludes.

II. DATA

The analysis conducted in the present paper uses a subset of the official indicators developed by the Inter-agency and Expert Group on Sustainable Development Goal Indicators and agreed upon at the forty-eighth session of the United Nations Statistical Commission, held in March 2017. The indicators were obtained from the United Nations Global SDG Indicators Database.[3] It is important to note that the analysis of the Sustainable Development Goals as a complex system, in particular the interlinkages between countries and indicators, requires as much information of the "system" as possible, in terms of both the number of countries and the number of indicators. However, important gaps remain in the availability of data, especially for developing countries.

In building the data set for the analysis, it is possible to prioritize completeness in the number of indicators at the expense of leaving out a large number of developing countries, or covering as many developing countries as possible but with fewer indicators available for each country. The criteria for the selection of indicators included in the analysis, described below, are aimed at covering the 17 Sustainable

---

[1] See ESCAP (2016) and Cho, Isgut and Tateno (2016) for an overview of the methods used.

[2] See, for example, International Council for Science and International Social Science Council (2015) and Le Blanc (2015).

[3] The database is available from https://unstats.un.org/sdgs/indicators/database/ (accessed 8 September 2017).

Development Goals, while still providing a comprehensive coverage of developing countries. In the majority of cases, the observations are for 2014 or later years.

The selection of indicators is based on the following criteria. First, the indicators are categorized as official Sustainable Development Goals indicator series in the Global SDG Indicators Database – supplementary indicator series are excluded.[4] Second, the indictors are available for at least 50 per cent of the Asia-Pacific countries and at least 50 per cent of the world's countries. Third, the chosen indicators cover the 17 Sustainable Development Goals. Fourth, to ensure that a single target is not overrepresented in the system, not more than two indicator series have been selected for each Sustainable Development Goal target. Fifth, a single observation has been selected for each country, with the latest available being from 2010 onwards. Using those criteria, a total of 75 indicators representing the 17 Goals have been obtained.

For the chosen set of 75 indicators, however, there are still many missing observations for developing countries. To increase the representativeness of the analysis to developing countries, the multiple imputation technique developed by Rubin (1987) is used to impute missing observations.[5] The use of imputation is limited to countries that have data for more than 75 per cent of the 75 indicators (56 or more). The imputation technique uses information regarding the relationships between the 75 indicators to predict missing values. After the imputation, the number of countries is 170, covering a large number of developing countries.[6] In the data set, the indicators are normalized between 0 and 100, with higher values representing higher attainment.[7] See the annex for the final list of indicators and countries included for the analysis.

Based on the list of indicators described above, the Sustainable Development Goal attainment of Pakistan is reviewed to reveal areas of strength and weakness by comparing the country with averages for the world and selected country groups. The attainment for each Goal is calculated as the average of the indicators that represent it.

---

[4]   Because the analysis requires continuous variables, indicators based on binary or non-scale variables are excluded from the indicator list. In addition, the total number of indicators available for each country in the Global SDG Indicators Database is used as a measure of a country's statistical capability (Sustainable Development Goal target 17.18).

[5]   Without using imputation, the subset of countries with full information for the 75 indicators would provide a biased sample, as it would exclude those with less institutional capacities to collect statistical information.

[6]   Pakistan has data for 68 of the 75 indicators.

[7]   See Cho, Isgut and Tateno (2016) for details.

Figure 1 shows that Pakistan is doing relatively well with regard to Sustainable Development Goal 7 on affordable and clean energy and Sustainable Development Goal 13 on climate action, compared to other lower-middle-income countries, and is on par with the upper-middle-income countries.[8] Pakistan is on par with the lower-middle-income countries with regard to Sustainable Development Goal 17 on partnerships for the Goals and Sustainable Development Goal 15 on life on land.

Figure 1. Attainment of Pakistan across the Sustainable Development Goals
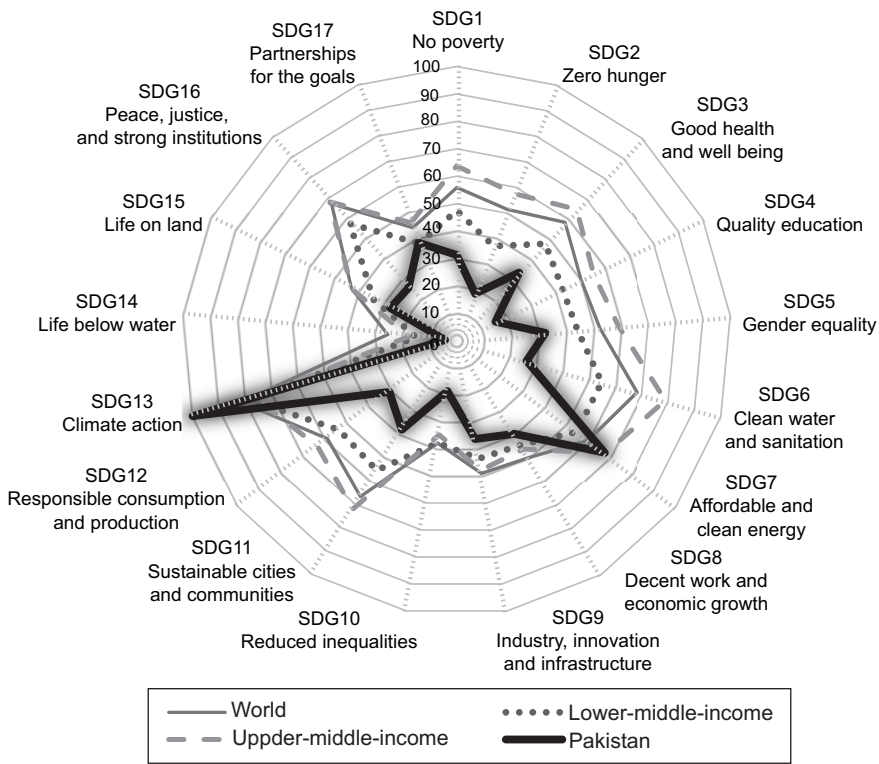
Source: Authors' calculation.

Note: The figure reports the attainment of Pakistan compared with averages for the world and selected country groups. The scores are normalized between 0 and 100, with higher values representing higher attainment.

---

[8]   The information on Sustainable Development Goal 13 on climate action is still very incomplete in the Global SDG Indicators Database. The only indicator available for a large number of countries for this goal at the time of writing was people affected by disasters per 1,000 of the population. The latest observation for this indicator for Pakistan was 0.1, which was among the lowest globally.

However, the country is lagging other lower-middle-income countries in, for example, Sustainable Development Goal 2 on zero hunger, Sustainable Development Goal 4 on quality education, Sustainable Development Goal 6 on clean water and sanitation, and Sustainable Development Goal 10 on reduced inequalities.

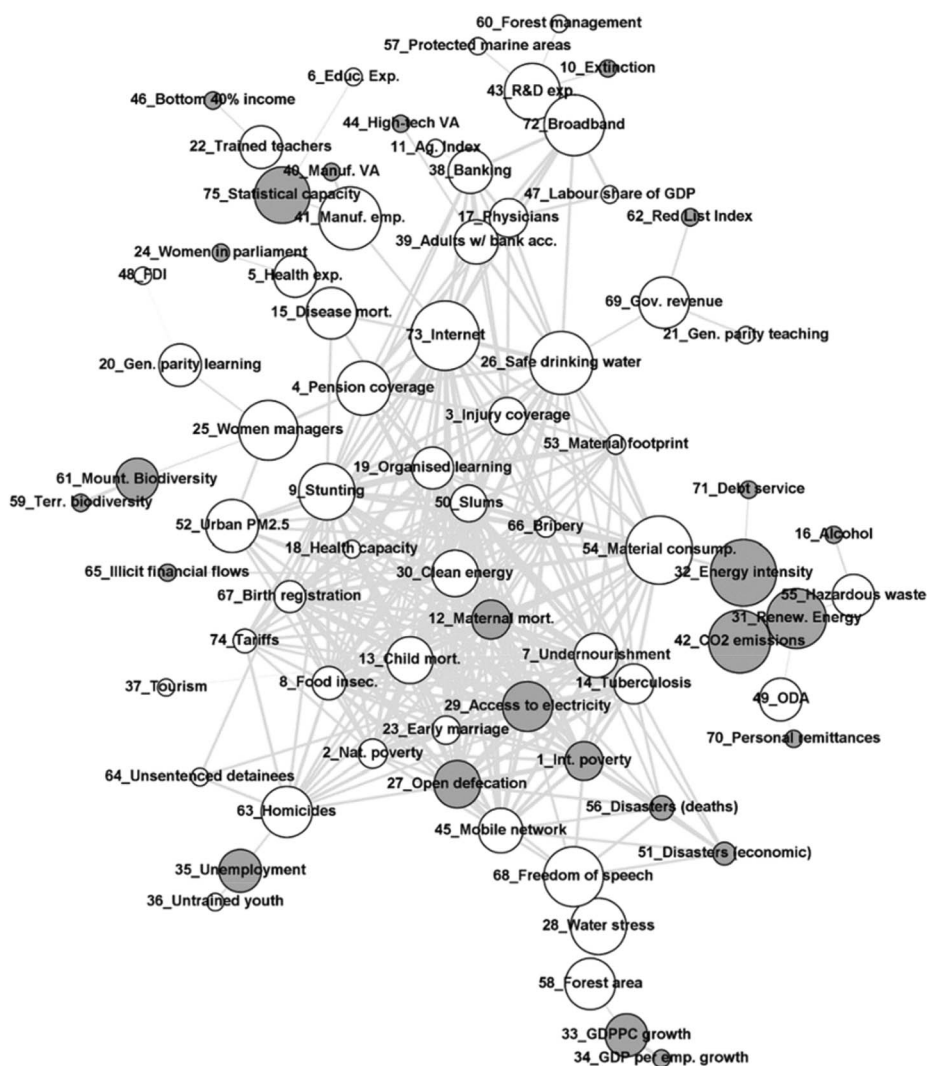## III. THE SDG SYSTEM FROM THE PERSPECTIVE OF PAKISTAN

The function of the Sustainable Development Goal indicators described above is to measure the degree of attainment of the Sustainable Development Goal by individual countries. As mentioned in the introduction, the Goals and associated targets in the 2030 Agenda are, to a greater or lesser extent, interdependent, and the same should be the case for the indicators chosen to measure the Goals and targets. The objective of this section is to graph the interdependencies among the 75 available Sustainable Development Goal indicators as a network – the SDG system.

The construction of the network involves the calculation of proximity scores that capture how related one indicator is with another in terms of the levels of attainment. More specifically, for all pairs of Sustainable Development Goal indicators and for the entire sample of 170 countries, the probability of other countries having a higher level of attainment in one indicator conditional on having a higher level of attainment in another indicator is computed for each country. This probability measure is used as a proxy to the proximity, or the relatedness, of one indicator to another within the SDG system, with a higher probability suggesting that the two indicators move closely together. Once the proximity scores are calculated for all pairs of Sustainable Development Goal indicators, the network is constructed using the concept of a "maximum spanning tree", which consists in connecting all the nodes in the network by the highest probability link for each pair of Sustainable Development Goal indicators.[9]

Figure 2 shows the network of Sustainable Development Goal indicators or SDG system for Pakistan. The light grey nodes represent indicators in which Pakistan is doing better than the average of lower-middle-income countries. The thickness of the lines connecting two nodes represents the proximity of those two indicators. The

---

[9]   For instance, if indicator A is linked to indicator B with a probability of 0.9 and to indicator C with probability 0.7, only the link between A and B is included in the network. After this step, all other links that represent probabilities greater than 0.85 are added to the tree. Following with the example, if indicator A is linked to indicator D with a probability of 0.87, the link between A and D is also included in the network. For more details on this methodology, see Hidalgo and others (2007).

Figure 2. The SDG system from the perspective of Pakistan

Notes: (a) The dark nodes represent indicators in which Pakistan is doing better than the lower-middle-income country average. (b) The size of the nodes represents their importance as gatekeepers, namely, how important they are as middle links for Pakistan to progress towards better attainment in other indicators. (c) Acronyms used: R&D, research and development; GDP, gross domestic product; GDPPC, GDP per capita; CO2, carbon dioxide; and ODA, official development assistance.

size of the nodes represents the number of shortest paths from all nodes to all others that pass through that node, which can be referred to as "gatekeeper nodes".[10]

It can be seen clearly that the SDG system facing Pakistan has a densely connected core area, representing indicators that are highly related to each other. This area of the network contains mostly social indicators, such as child and maternal mortality, undernourishment, tuberculosis and slums, but it also includes access to electricity and clean energy. In addition, there are several peripheral areas that represent indicators that are less connected to both the core of the system and the other peripheral areas. Representative indicators in some of those peripheral areas include: per capita gross domestic product (GDP) growth, unemployment, biodiversity, women in parliament, statistical capacity, research and development expenditure, government revenue and carbon dioxide (CO2) emissions.

The figure shows that Pakistan is doing better than the lower-middle-income countries in such indicators as maternal mortality, access to electricity, open defecation, per capita gross domestic product growth, unemployment, biodiversity, statistical capacity and CO2 emissions. Indicators in which Pakistan is doing worse than lower-middle-income countries include undernourishment, stunting, tuberculosis, child mortality, slums, clean energy, safe drinking water, women managers, government revenue and pension coverage.

IV. THE SUSTAINABLE DEVELOPMENT GOAL IMPLEMENTATION CAPACITY OF PAKISTAN

As mentioned in the introduction, countries are characterized by different levels of capacity to achieve the Sustainable Development Goals. It is important to measure such capacities as they provide an indication of how much progress individual countries can make towards the attainment of the Goals by 2030. The purpose of this section is to explain how the SDG system described in the previous section can be used to measure such capacities in each of the countries included in the analysis.

The capacities of countries to achieve the Sustainable Development Goals can be thought of as building blocks or Lego pieces, with the attainment of a specific Sustainable Development Goal indicator being analogous to a Lego model and a country being analogous to a bucket of Legos (Hidalgo and Hausmann, 2009).

---

[10] The shortest path between two nodes in a network is the minimum number of nodes that connect those two nodes. The number of shortest paths that pass through a particular node in the network is called its betweenness centrality. In the SDG system, nodes with a high degree of betweenness centrality represent Sustainable Development Goal indicators that are strongly connected with other Sustainable Development Goal indicators.

Countries are able to achieve higher attainment in a particular Sustainable Development Goal indicator (a more complex Lego model) only if the relevant capacities (Lego blocks) needed to increase attainment in an indicator are available within the country's set of capacities (the Lego bucket). However, those capacities – which include all aspects within the spectrum of socioeconomic capacities and natural resources relevant in achieving progress – are difficult if not impossible to observe directly.

It is possible, however, to indirectly measure the unobservable capacities that Pakistan possesses using the information of all countries and their attainment across all indicators. This is done by analysing the relative attainment of Pakistan across Sustainable Development Goal indicators, compared to all the other countries used in our sample. If Pakistan is achieving higher attainment in a particular indicator relative to the other countries, then Pakistan is considered to have the capacities to build that more complex "Lego model." If Pakistan is struggling in a particular indicator, this suggests that it does not yet have the required capacities needed to make progress towards better attainment in that indicator.

In essence, the capacity measure – calculated using the "Method of Reflections"[11] – awards a higher capacity value if a country is doing well in indicators that other countries are struggling with, as this is suggestive of the country possessing unique capacities that others do not have. Figure 3 shows a comparison of the calculated capacity values for Pakistan with the group of lower-middle-income countries. On a scale of 0 to 100, the country's capacity is about 46, slightly below the average for the lower-middle-income countries (53.7). Countries in proximity to Pakistan, such as Bangladesh, Myanmar, Sri Lanka and Viet Nam, are seen to possess roughly the same level of capacities as Pakistan. Compared to the rest of the world, the capacity level of Pakistan is about 70 per cent of the world average.
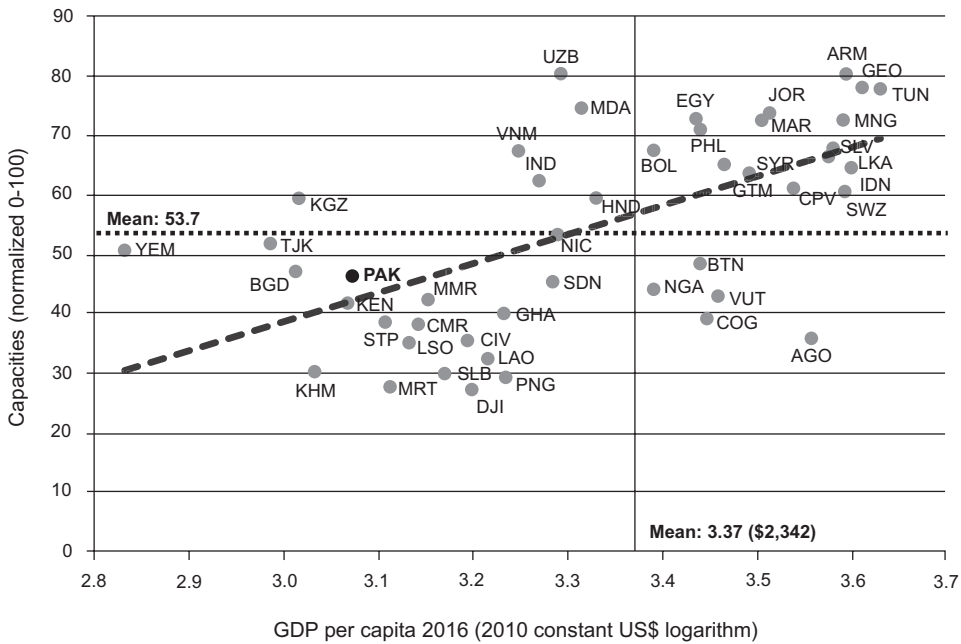
---

[11]   See the annex for a brief overview of the Method of Reflections. For a more in-depth description of the method used in the analysis, see Hidalgo and Hausmann (2009) and Cho, Isgut and Tateno (2016).

Figure 3. SDG capacities of lower-middle-income countries
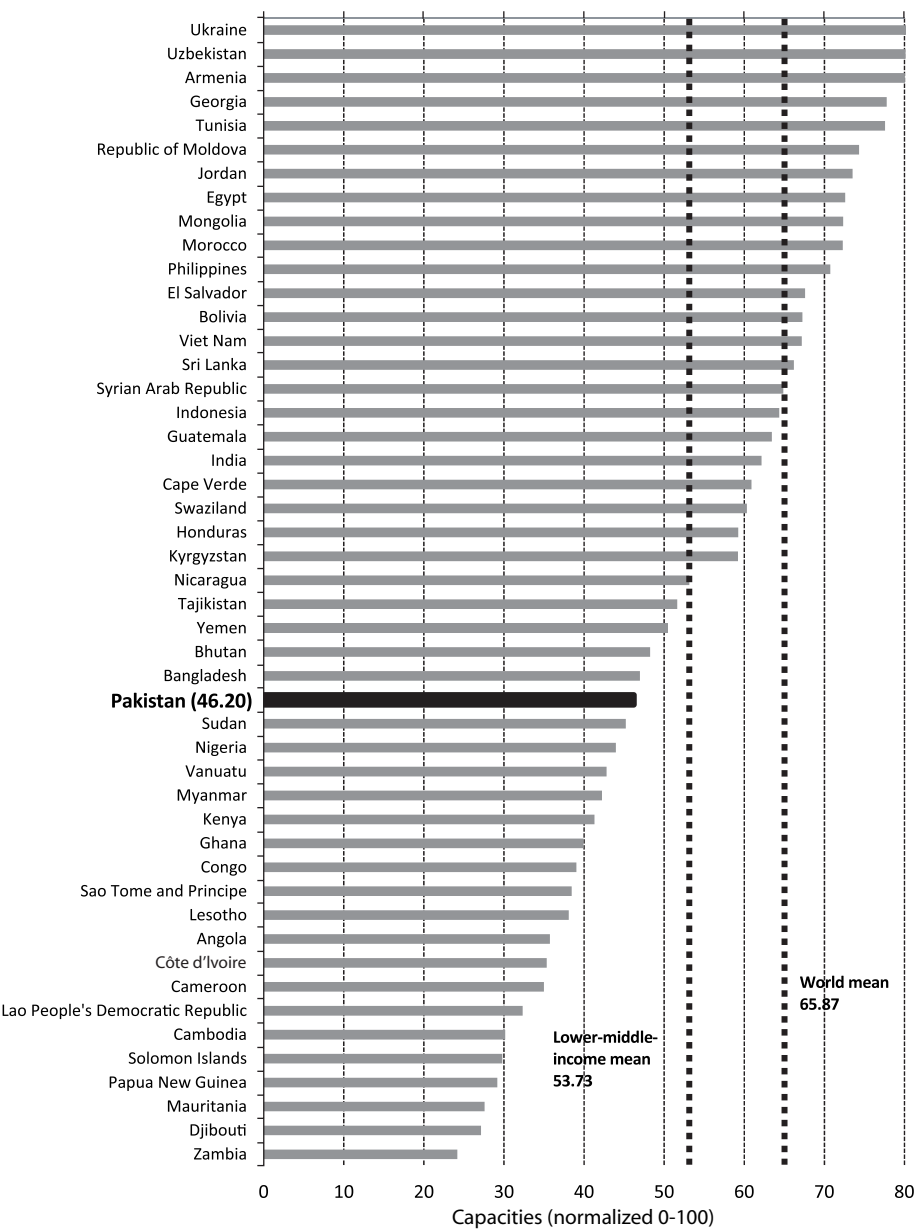
Source: Authors' calculation.

**Figure 4. SDG capacities versus gross domestic product per capita
(lower-middle-income countries)**

GDP per capita 2016 (2010 constant US$ logarithm)

Source:　Authors' calculation.

Note:　AGO, Angola; ARM, Armenia; BGD, Bangladesh; BOL, Bolivia (Plurinational State of); BTN, Bhutan; CIV, Côte d'Ivoire; CMR, Cameroon; COG, Congo; DJI, Djibouti; EGY, Egypt; GEO, Georgia; GHA, Ghana; CPV, Cabo Verde; GTM, Guatemala; HND, Honduras; IDN, Indonesia; IND, India; JOR, Jordan; KEN, Kenya; KGZ, Kyrgyzstan; KHM, Cambodia; LAO, Lao People's Democratic Republic; LKA, Sri Lanka; LSO, Lesotho; MAR, Morocco; MDA, Republic of Moldova; MMR, Myanmar; MNG, Mongolia; MRT, Mauritania; NGA, Nigeria; NIC, Nicaragua; PAK, Pakistan; PHL, Philippines; PNG, Papua New Guinea; SLB, Solomon Islands; SLV, El Salvador; STP, Sao Tome and Principe; SWZ, Swaziland; SDN, Sudan; SYR, Syrian Arab Republic; TJK, Tajikistan; TUN, Tunisia; UZB, Uzbekistan; VNM, Viet Nam; VUT, Vanuatu; and YEM, Yemen.

V. OPTIMAL PATHWAYS FOR PROGRESS

Based on the SDG system described in section III and the measure of SDG capacity explained in section IV, it is possible to set up an optimization problem to identify the optimal pathway for Pakistan to progress towards achieving the Sustainable Development Goals. The first step is to identify a group of countries with similar levels of attainment of the Sustainable Development Goals as Pakistan. This group of "peers" is defined as 10 countries with SDG capacities higher than Pakistan and 10 countries with SDG capacities lower than Pakistan, and it includes

Figure 5. SDG capacities versus the human development index
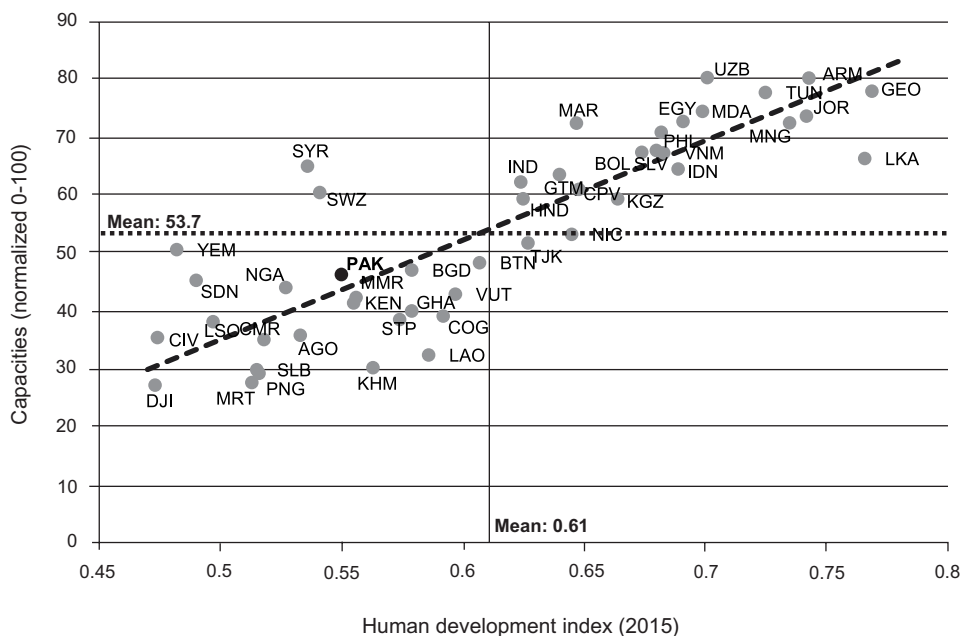### (lower-middle-income countries)

Source: Authors' calculation.

Note: AGO, Angola; ARM, Armenia; BGD, Bangladesh; BOL, Bolivia (Plurinational State of); BTN, Bhutan; CIV, Côte D'Ivoire; CMR, Cameroon; COG, Congo; DJI, Djibouti; EGY, Egypt; GEO, Georgia; GHA, Ghana; CPV, Cabo Verde; GTM, Guatemala; HND, Honduras; IDN, Indonesia; IND, India; JOR, Jordan; KEN, Kenya; KGZ, Kyrgyzstan; KHM, Cambodia; LAO, Lao People's Democratic Republic; LKA, Sri Lanka; LSO, Lesotho; MAR, Morocco; MDA, Republic of Moldova; MMR, Myanmar; MNG, Mongolia; MRT, Mauritania; NGA, Nigeria; NIC, Nicaragua; PAK, Pakistan; PHL, Philippines; PNG, Papua New Guinea; SLB, Solomon Islands; SLV, El Salvador; STP, Sao Tome and Principe; SWZ, Swaziland; SDN, Sudan; SYR, Syrian Arab Republic; TJK, Tajikistan; TUN, Tunisia; UZB, Uzbekistan; VNM, Viet Nam; VUT, Vanuatu; and YEM, Yemen.

Bangladesh, Bhutan, Cabo Verde, Congo, Ghana, Honduras, Kenya, Kyrgyzstan, Myanmar, Nicaragua, Nigeria, Samoa, Sao Tome and Principe, Senegal, Sudan, Swaziland, Tajikistan, Timor-Leste, Vanuatu and Yemen.

The optimization problem uses the SDG capacities estimated in the previous section as a planning tool to guide Pakistan on the prioritization and sequencing of the attainment of indicators over time. For that purpose, the value of the capacities measured can be calculated for a small increase in the value of a number of indicators, one at a time, selecting the indicator that yields the largest increase in

SDG capacities. Iterating this calculation many times can produce an "optimal" pathway for progress towards the achievement of the Sustainable Development Goals.

To reduce the computational burden, the optimization algorithm limits the number of indicators that Pakistan can improve upon. The set of indicators eligible for improvement is identified by the SDG system and the position of Pakistan within it, based on: (a) the degree of complexity of indicators; (b) current attainment level compared to peers; and (c) potential synergies across indicators. The selection of those characteristics is based on three assumptions.

The first assumption is that it is less costly to make progress in indicators that are less complex. The level of complexity of each indicator is obtained as a as part of the calculation of the measure of SDG capacity with the method of reflections. Thus, the selection of indicators to be considered for improvement in the optimization algorithm favours indicators that are less complex. The second assumption is that countries with similar SDG capacities should be able to attain similar levels of progress in each individual indicator. Thus, the algorithm favours indicators in which Pakistan is lagging far behind its peers – they can be considered "low hanging fruits." The third assumption is that improvement in indicators that are connected to several other indicators in the SDG system, referred to as gatekeeper indicators, may create synergies with other indicators.[12] Thus, the algorithm favours indicators with high betweenness centrality, represented by large notes in figure 2 above.

In table 1, the suggested priority areas for Pakistan based on the objective of maximizing SDG capacities are laid out. The results are aggregated into three five-year phases: 2016-2020, 2021-2025 and 2026-2030. The priority levels for each indicator are calculated as the percentage of steps in each phase for which the indicator is chosen as a priority, relative to the total number of steps in each phase.

In the first phase (2016-2020), the optimal pathway emphasizes improvements in information and communications technology (ICT) infrastructure and Internet users, followed by an expansion in the network of automated teller machines (ATMs), increasing the number of physicians, and the protection of forests. In the second phase (2021-2025), ICT infrastructure and Internet users continue to be important but the expansion of access to bank accounts becomes the top priority, followed by expenditure on research and development. Increasing the number of physicians and

---

[12] An example could be the development of rural energy, which could facilitate the expansion of business and employment opportunities, thus reducing poverty, and the operation of rural medical clinics, leading to improvements in health outcomes.

protecting the forests remains important but less than in the first phase. In the third phase (2026-2030), the top priority becomes improving access to safe drinking water, followed by investing in clean fuel technologies, two new priorities. In decreasing order of importance, expenditure in research and development, ICT investment and expansion of ATMs follow.

Table 1. Suggested areas of priority for Pakistan

Goal	Indicator	Priority level (%)
Early stage (2016-2020)		
17	Internet users	25.9
8	Number of automated teller machines (ATMs)	22.3
17	Fixed-broadband subscriptions	20.3
3	Physicians density	19.3
15	Forest certified under an independently verified certification scheme	12.2
Transition phase (2021-2025)		
8	Proportion of adults (15 years and older) with an account at a bank	40.6
17	Fixed-broadband subscriptions	16.3
17	Internet users	13.9
9	Gross domestic expenditure on research and development	11.4
3	Physicians density	8.9
8	Number of automated teller machines (ATMs)	5.9
15	Forest certified under an independently verified certification scheme	3.0
Towards maturity (2026-2030)		
6	Population using safely managed drinking water	38.3
7	Clean fuel and technologies (usage rate)	19.1
9	Gross domestic expenditure on research and development	12.9
8	Number of automated teller machines (ATMs)	8.1
17	Fixed-broadband subscriptions	6.2
17	Internet users	5.3
8	Proportion of adults (15 years and older) with an account at a bank	4.8
3	Physicians density	4.3
15	Forest certified under an independently verified certification scheme	1.0

Source: Authors' calculations.

Note: Priority levels for the indicators are calculated as the percentage of steps in each phase for which the indicator is chosen as a priority relative to the total number of steps in each phase.

Several characteristics can be drawn from these results regarding the optimal pathways for the implementation of the 2030 Agenda in Pakistan. The first one is a large concentration in a relatively small number of indicators: ICT investment, ATMs and bank accounts, drinking water, physicians, forests and expenditure in research and development. This suggests a strategic approach for the achievement of the Goals, with a heavy policy focus on selected areas of great importance to Pakistan. A second characteristic is that the results are dependent on the country's position in the SDG system, tending to emphasize "low hanging fruits" or indicators in which Pakistan is underperforming compared with other countries with similar levels of SDG capacities.

A third characteristic of the optimal pathways is sequencing, in the sense that the priorities vary from phase to phase.

Figure 6 illustrates the relative importance of each Sustainable Development Goal during subsequent phases of development for Pakistan. Goal 17 (partnerships for the Goals), followed by Goal 8 (decent work and economic growth), Goal 3 (good health and well-being), and Goal 15 (life on land) is particularly important early on. Goal 8 (decent work and economic growth) and Goal 6 (clean water and sanitation) become the most important in the second and third phases, respectively.

An interesting result is that some of the prioritized indicators, including broadband, Internet, expenditure in research and development, and safe drinking water, coincide with the core gatekeeper nodes of the preceding network analysis (see figure 2). Those findings suggest that, given the current level of capacity, Pakistan has the potential to improve on various Sustainable Development Goal indicators, even in areas where the country has been lagging relative to its peers. In fact, it would be efficient if Pakistan prioritizes those indicators because it would contribute to increasing the country's SDG capacity and accelerate progress towards the achievement of the Goals.

Figure 7 illustrates how the position of Pakistan within the SDG system would change by implementing the optimal pathway. As in figure 2 the light grey nodes represent indicators in which Pakistan is performing better than the lower-middle-income country average. The dark grey nodes represent indicators in which Pakistan is predicted to exhibit higher attainment levels relative to lower-middle-income countries in 2030 if it follows the optimal pathway. Those indicators are prioritized in the optimal pathway, indicating that improving their attainment is effective for Pakistan. Finally, the white nodes represent indicators that are expected to remain below the lower-middle-income country average by 2030.

Figure 6. Priority Sustainable Development Goals for the implementation
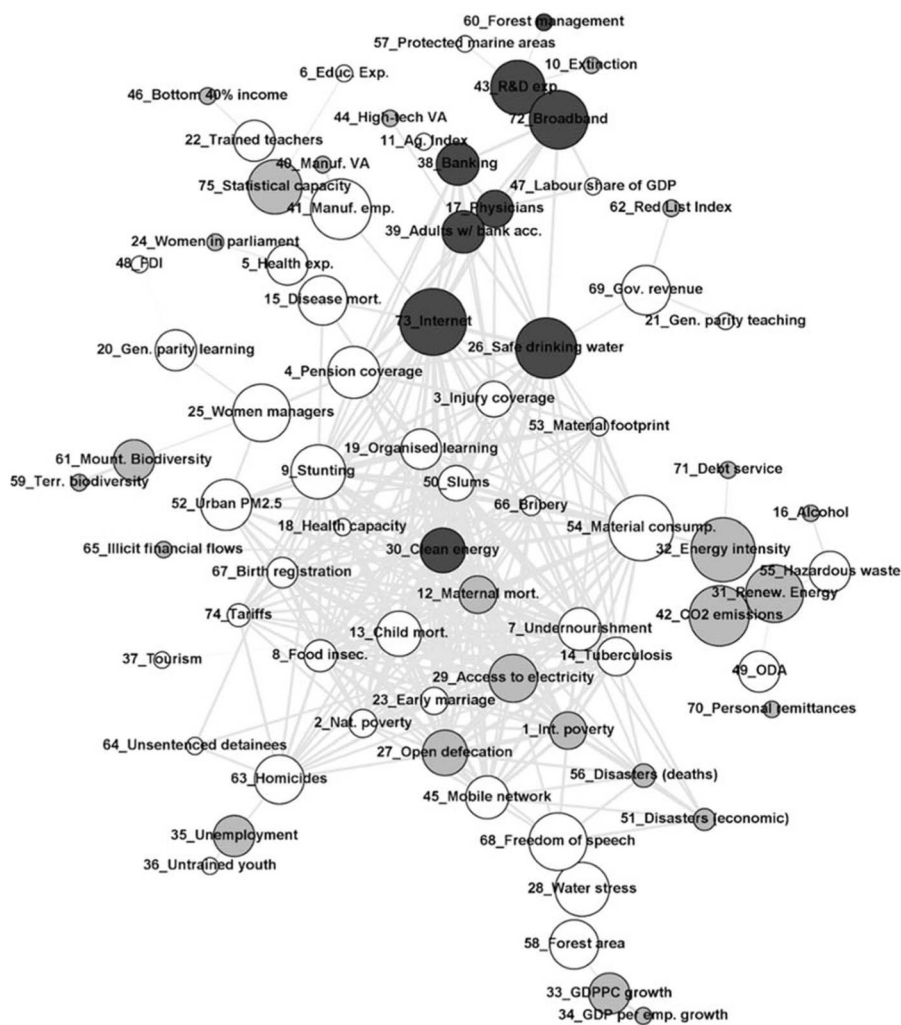of the 2030 Agenda
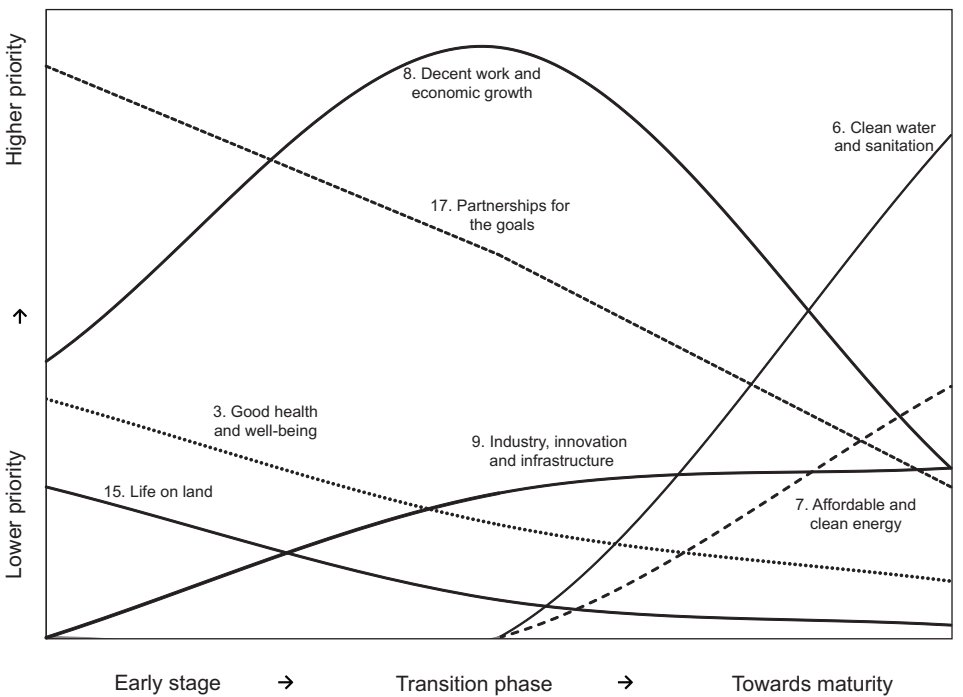
Source: Authors' calculations.

Figure 7 illustrates that Pakistan is slowly migrating from the nodes that are scattered at the upper portion of the network towards the core of the system, where indicators are densely connected. The optimal pathway projected in this figure includes improvements in indicators, such as expenditure in research and development, broadband, Internet, drinking water, physicians, and access to bank accounts, that are important gatekeeper nodes in the SDG system.

The figure, however, illustrates that most of the progress by 2030 is expected to take place only in the upper portion of the network. The core of the network contains a cluster of indicators, represented by white nodes, in which Pakistan will not be able to outperform the lower-middle-income countries even by 2030. Those indicators are represented by nodes that are densely connected. They are related to gender, health, hunger and education, such as child mortality and stunting, all of which are identified as areas of weakness in the country in section II. The analysis

Figure 7. The optimal pathway for progress in Pakistan

Notes: (a) The size of nodes represents their importance as gatekeepers, namely how important they are as middle links for Pakistan to progress towards better attainment in other indicators; and (b) nodes are coloured based on the level of attainment of Pakistan compared with lower-middle-income countries. Light grey nodes are those in which Pakistan exhibits higher attainment levels compared with lower-middle-income countries presently, while dark grey nodes are those in which Pakistan is predicted to exhibit higher attainment levels relative to lower-middle-income countries in 2030 if it follows the optimal pathway. (c) Acronyms used: R&D, research and development; GDP, gross domestic product; GDPPC, GDP per capita; CO2, carbon dioxide; and ODA, official development assistance.

implies that Pakistan will need more time to accumulate sufficient capacities to address those challenges.

VI. SCENARIO ANALYSIS

The optimization exercise described above is further complemented by a comparative analysis of alternative scenarios, the results of which are compared in terms of the predicted levels of the human development index against the model-proposed optimal pathway. In particular, the optimal pathway described above is compared with a second scenario based on the country's development plan, Vision 2025 (box 1). This scenario is constructed by obtaining the optimal pathway in which only Sustainable Development Goal indicators that are substantially covered by Vision 2025 are selected. In the second scenario, some of the goals corresponding to gender (Sustainable Development Goal 5),[13] cities (Sustainable Development Goal 11), sustainable consumption and production (Sustainable Development Goal 12), climate change (Sustainable Development Goal 13), oceans (Sustainable Development Goal 14) and terrestrial ecosystems (Sustainable Development Goal 15) are excluded. For a third scenario, for comparison purposes, a randomized pathway in which progress is made in arbitrary order is considered. This scenario is extreme and unrealistic, but it is an attempt to mimic the situation in which there is absolutely no focused area or policy coordination among various government institutions.

In summary, the following three scenarios are analysed:

1.   The model-proposed optimal pathway;

2.   The optimal pathway for progress within the focus of Vision 2025;

3.   A randomized pathway for progress that does not give precedence to any indicator over another.

Future levels of the human development index for Pakistan are estimated under the different scenarios on the basis of the historical relationship between the human development index and the measure of SDG capacity shown in figure 5 above. The results of the three scenarios are shown in figure 8. For comparison purposes, the figure shows the historical trends in the human development index for Pakistan.

---

[13]   While gender issues are present in pillar 1, only 2 specific indicators (primary and secondary education parity and workforce participation) are included, and thus gender is considered not to be a core area of improvement.

Box 1. Vision 2025

After an extensive process of consultation with parliamentarians, federal ministries, provincial governments, business leaders, international institutions, universities, think tanks and non-governmental organizations concluded in a national conference on 22 November 2013, the Government of Pakistan compiled its Vision 2025 (Pakistan, 2014). This aspirational document includes a compilation of the consensus views of national and international stakeholders regarding the future direction of the country. It provides a conceptual platform for the achievement of sustainable and inclusive growth for the benefit of all the citizens of Pakistan, thus offering a national approach for meeting globally agreed goals and targets, including the Sustainable Development Goals. As shown in the table below Vision 2025 includes five enablers and seven pillars, with many pillars overlapping with the Sustainable Development Goals contained in the 2030 Agenda for Sustainable Development.

Pakistan Vision 2025: enablers, pillars, and corresponding Sustainable Development Goals

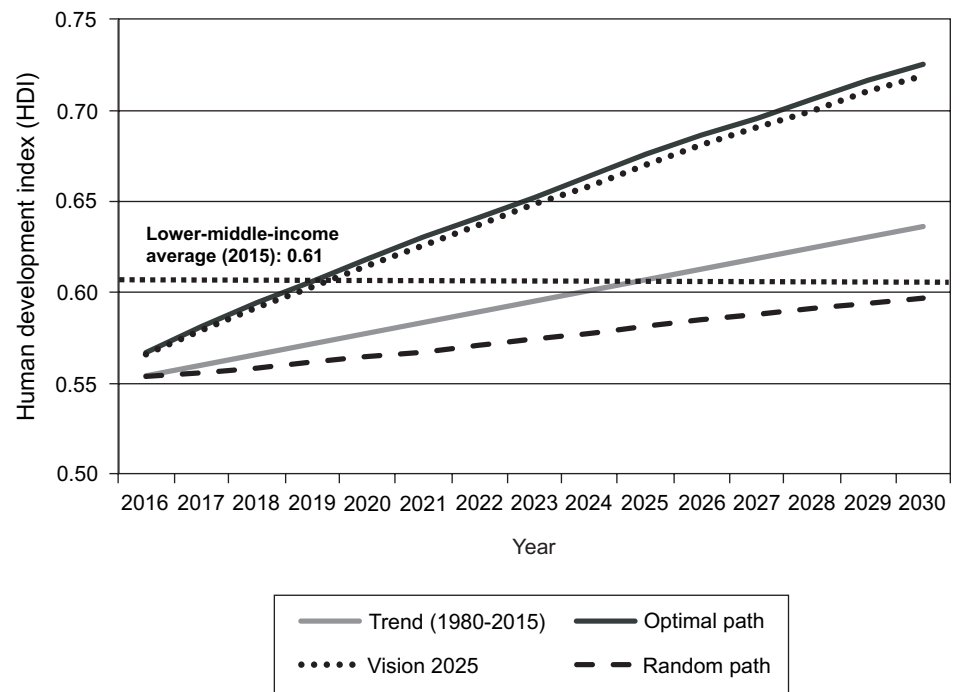| Pakistan Vision 2025		Sustainable Development Goals
Enablers and pillars	**Goals**	
Enabler I: Shared national vision **Enabler II**: Political stability and continuity of policies **Enabler III**: Peace and security **Enabler IV**: Rule of law **Enabler V**: Social justice		**Goal 16**: Peace, justice and strong institutions
Pillar I: Putting people first – developing human and social capital	1, 2, 3, 4, 5, 6, 7	**Goal 3**: Good health and well-being **Goal 4**: Quality education **Goal 5:** Gender equality **Goal 6**: Clean water and sanitation
Pillar II: Achieving sustained, indigenous and inclusive growth	8, 9, 10, 11	**Goal 1**: No poverty **Goal 8**: Decent work and economic growth **Goal 10**: Reduced inequalities **Goal 17**: Partnerships for the Goals

Table *(continued)*

Pakistan Vision 2025		Sustainable Development Goals
Enablers and pillars	**Goals**	
Pillar III: Governance, institutional reform and modernization of the public sector	12	**Goal 16**: Peace, justice and strong institutions
Pillar IV: Energy, water and food security	13, 14, 15, 16	**Goal 2:** Zero hunger **Goal 6**: Clean water and sanitation **Goal 7**: Affordable and clean energy
Pillar V: Private sector-led growth	17, 18, 19	**Goal 8**: Decent work and economic growth
Pillar VI: Developing a competitive knowledge economy through value addition	20, 21, 22, 23	**Goal 8**: Decent work and economic growth **Goal 9**: Industry, innovation and infrastructure
Pillar VII: Modernizing transportation infrastructure and greater regional connectivity	24, 25	**Goal 9**: Industry, Innovation and infrastructure

Source: Authors, based on the information from the Ministry of Planning, Development and Reform, Government of Pakistan, *Pakistan Vision 2025: One Nation – One Vision, Executive Summary*, and the 2030 Agenda for Sustainable Development.

Figure 8 shows that the optimal pathway results in the highest levels of the human development index, while the pathway defined by Vision 2025 follow a slightly lower trajectory than the optimal Sustainable Development Goals pathway. This suggests that Vision 2025 is a good match for the priorities of Pakistan for the implementation of the 2030 Agenda from the present until and 2030. Furthermore, the predicted trajectories in the human development index associated with both the optimal and the pathway defined by Vision 2025 greatly exceed the historical trend of the human development index. Finally, the random pathway would be unable to guarantee that Pakistan could keep up with or exceed past trends in annual increases.

Overall, the results suggest the following:

1. Planning and prioritization are essential for progress towards sustainable development as the expected outcome from randomized policies are strictly inferior, justifying the need for policy coordination across different state agencies and across different levels of governments.

Figure 8. Comparison of scenarios

Source: Authors' calculation.

2. Vision 2025 is expected to contribute to progress towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner.

3   The lack of progress expected in addressing issues related to gender, health, hunger and education, noted in the previous section, will require careful consideration by national policymakers of Pakistan and development partners.

VII. CONCLUSIONS

In the present paper, an attempt is made to understand how a country could move forward in implementing the 2030 Agenda, taking into account its level of development and unique capacities. The paper is focused on the case of Pakistan, based on the framework developed by Cho, Isgut and Tateno (2016). The analysis is

based on a data set that includes 75 indicators and 170 countries available from the Global SDG Indicators Database at the time of writing (September 2017).

The analysis of the SDG system as a network of interconnected indicators has identified an optimal pathway towards the achievement of the Sustainable Development Goals for Pakistan, given the country's current capacities. It has found that the country's national development plan, Vision 2025, is expected to contribute to progress towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner. However, the analysis suggests that Pakistan would need more time to accumulate sufficient capacities to address challenges in areas related to gender, health, hunger and education.

It must be noted that the analysis conducted in this paper is based on an initial set of indicators from the Global SDG Indicators Database. As the data for the Sustainable Development Goal indicators become available for more countries in coming years, the analytical framework used for this paper will be refined and improved by enhancing the coverage and representativeness of the Sustainable Development Goals.

REFERENCES

Cho, Jaebeum, Alberto Isgut, and Yusuke Tateno (2016). An analytical framework for identifying optimal pathways towards sustainable development. MPFD Working Papers, WP/16/03. Bangkok: ESCAP.

Hidalgo, César A., and Ricardo Hausmann (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences*, vol. 106, No. 26, pp. 10570-10575.

Hidalgo, César A., and others (2007). The product space conditions the development of nations. *Science*, vol. 317, No. 5837, pp. 482-487.

International Council for Science, and International Social Science Council (2015). *Review of Targets for the Sustainable Development Goals: The Science Perspective*. Paris: International Council for Science.

Le Blanc, David (2015). Towards integration at last? The sustainable development goals as a network of targets. DESA Working Paper, No. 141. New York: Department of Economic and Social Affairs of the United Nations.

Pakistan, Ministry of Planning, Development and Reform (2014). *Pakistan Vision 2025: One Nation – One Vision*. Available from http://fics.seecs.edu.pk/Vision/Vision-2025/Pakistan-Vision-2025.pdf.

Rubin, Donald B. (1987). *Multiple Imputation for Nonresponse in Surveys*. New York: John Wiley & Sons.

United Nations (2015). *Global Sustainable Development Report*. Available from https://sustainabledevelopment.un.org/content/documents/1758GSDR%202015%20Advance%20Unedited%20Version.pdf.

United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP) (2016). *Asia-Pacific Countries with Special Needs Development Report 2016: Adapting the 2030 Agenda for Sustainable Development at the National Level*. Sales No. E.16.II.F.11.

ANNEX

Table A. List of indicators used for analysis

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
1	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day	1.1.1 Poor living on less than US$1.90 a day in total employment, 15+ years (% of total employment)
	1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Population living below the national poverty line (% of population)
	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Employed population covered in the event of work injury (% of employed population) 1.3.1 Population above retirement age receiving a pension (% of population)
	1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions	1.a.2 General government health expenditure (% of total government expenditure) 1.a.2 Public expenditure on education (% of total government expenditure)
2	2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment (percentage) 2.1.2 Moderate or severe food insecurity in the population (% of population)
	2.2 By 2030, end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons	2.2.1 Children moderately or severely stunted (% of children under 5)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.2 Local breeds classified as being at unknown level of risk of extinction (percentage)
	2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	2.a.1 Agriculture orientation index (index)
3	3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	3.1.1 Maternal mortality (deaths per 100,000 live births)
	3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	3.2.1 Under-five mortality rate (deaths per 1,000 live births)
	3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	3.3.2 Tuberculosis incidence rate (per 100,000 population)
	3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes, or chronic respiratory diseases (probability, %)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.2 Alcohol per capita consumption (litres per annum)
	3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	3.c.1 Physicians density (per 10,000 population)
	3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	3.d.1 International Health Regulations core capacity index (index)
4	4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	4.2.2 Participation rate in organized learning, one year before the official primary entry age (percentage)
	4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations	4.5.1 Gender parity index for participation rate in organized learning, one year before the official primary entry age (female-to-male ratio) 4.5.1 Gender parity index of teachers in primary education who are trained (female-to-male ratio)
	4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	4.c.1 Trained teachers, primary education (percentage)
5	5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation	5.3.1 Percentage of women aged 20 to 24 years who were first married or in union before age 18 (percentage)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	5.5.1 Seats held by women in national parliament (% of seats) 5.5.2 Women in managerial position (percentage)
6	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Population using safely managed drinking water (% of population)
	6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Population practicing open defecation (% of population)
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.2 Total freshwater withdrawal (% of total renewable water per annum)
7	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Access to electricity, Sustainable Energy for All (SE4All) (% of population) 7.1.2 Clean fuel and technologies (CFT) usage rate (% of population)
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share of total final energy consumption (% of total final energy consumption)
	7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity from the Global Tracking Framework for Measuring Energy Access (in megajoules per unit of GDP in 2011 PPP)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
8	8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Average annual GDP per capita growth rate, 2005 US dollars (% change per capita per annum)
	8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Growth rate of GDP per employed person (% change per annum)
	8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.2 Unemployment rate, 15+ years (% of labour force)
	8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Not in education, employment or training (NEET) rates (% of population aged 15-24)
	8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.1 Outbound tourism expenditure (% of GDP)
	8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	8.10.1 Number of automated teller machines (ATMs) (per 100,000 adults) 8.10.2 Proportion of adults with an account at a bank (% of population aged 15 and above)
9	9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	9.2.1 GDP by activity: manufacturing (% of GDP) 9.2.2 Manufacturing employment (% of total employment)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 Carbon dioxide emissions (kg CO2 equivalent per 1 US$ GDP, 2005 PPP)
	9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Gross domestic expenditure on research and development (% of GDP)
	9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Medium and high-tech industry value added (% of total value added)
	9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Population covered by a mobile-cellular network (% of population)
10	10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates in per capita real survey mean consumption or income, bottom 40% (percentage)
	10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	10.4.1 Labour share of GDP (% of GDP)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes	10.b.1 FDI inflows (% of GDP) 10.b.1 Official development assistance (% of GDP)
11	11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Urban slum population (% of urban population)
	11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.2 Direct disaster economic, average annual loss (per 1,000 US$)
	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.2 Annual mean concentration of PM2.5 (micrograms per m^3)
12	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint total by type (kg per 1 US dollar, 2005 GDP) 12.2.2 Domestic material consumption intensity (kg per 1 US dollar, 2005 GDP)
	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	12.4.1 Hazardous waste, Basel Convention compliance (percentage)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
13	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Disasters, total people affected (per 1,000 population)
14	14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Protected areas in relation to marine area (percentage)
15	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area (% of land area) 15.1.2 Proportion of important sites for terrestrial biodiversity (percentage)
	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Forest certified under an independently verified certification scheme (percentage)
	15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Proportion of important sites for mountain biodiversity (percentage)
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red list index (index)
16	16.1 Significantly reduce all forms of violence and related death rates everywhere	16.1.1 Intentional homicide (per 100,000 population)
	16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	16.3.2 Unsentenced detainees, pre-trial (% of prison population)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	16.5 Substantially reduce corruption and bribery in all their forms	16.5.2 Illicit financial flows (% of GDP) 16.5.2 Bribery incidence, business asked for bribery (percentage)
	16.9 By 2030, provide legal identity for all, including birth registration	16.9.1 Birth registration (% of children under 5)
	16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	16.10.1 Killings of journalists and associated media personnel (number)
17	17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	17.1.1 Total general government revenue, Global Financial Statistics (% of GDP)
	17.3 Mobilize additional financial resources for developing countries from multiple sources	17.3.2 Personal remittances received (% of GDP)
	17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	17.4.1 Debt service (% of exports of goods, services and primary income)
	17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.2 Fixed-broadband subscriptions (per 100 population)

Table A. *(continued)*

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	17.8.1 Internet users (% of population)
	17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	17.10.1 Tariff rate, under most favoured nation status (percentage)
	17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	The total number of indicators out of the 74 used for analysis that are available for each country.

B. List of countries in the data set, after imputation

Afghanistan; Albania; Algeria; Angola; Argentina; Armenia; Australia; Austria; Azerbaijan; Bahrain; Bangladesh; Barbados; Belarus; Belgium; Belize; Benin; Bhutan; Bolivia (Plurinational State of); Bosnia and Herzegovina; Botswana; Brazil; Brunei Darussalam; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Canada; Cabo Verde; Central African Republic; Chad; Chile; China; Colombia; Comoros; Congo; Costa Rica; Côte d'Ivoire; Croatia; Cuba; Cyprus; Czech Republic; Democratic Republic of the Congo; Denmark; Djibouti; Dominican Republic; Ecuador; Egypt; El Salvador; Estonia; Ethiopia; Fiji; Finland; France; Gabon; Gambia; Georgia; Germany; Ghana; Greece; Guatemala; Guinea; Guinea-Bissau; Guyana; Haiti; Honduras; Hungary; Iceland; India; Indonesia; Iran (Islamic Republic of); Iraq; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Korea, Republic of; Kuwait;

Kyrgyzstan; Lao People's Democratic Republic; Latvia; Lebanon; Lesotho; Liberia; Lithuania; Luxembourg; Madagascar; Malawi; Malaysia; Maldives; Mali; Malta; Mauritania; Mauritius; Mexico; Mongolia; Montenegro; Morocco; Mozambique; Myanmar; Namibia; Nepal; Netherlands; New Zealand; Nicaragua; Niger; Nigeria; Norway; Oman; Pakistan; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Republic of Moldova; Romania; Russian Federation; Rwanda; Saint Lucia; Saint Vincent and the Grenadines; Samoa; Sao Tome and Principe; Saudi Arabia; Senegal; Serbia; Seychelles; Sierra Leone; Singapore; Slovakia; Slovenia; Solomon Islands; South Africa; Spain; Sri Lanka; Sudan; Suriname; Swaziland; Sweden; Switzerland; Syrian Arab Republic; Tajikistan; Thailand; the former Yugoslav Republic of Macedonia; Timor-Leste; Togo; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; United Arab Emirates; United Kingdom; United Republic of Tanzania; United States; Uruguay; Uzbekistan; Vanuatu; Venezuela; Viet Nam; Yemen; Zambia; and Zimbabwe.

C. The Method of Reflections

The Method of Reflections (Hidalgo and Hausmann, 2009) uses the information of the constructed network of (a) countries and (b) indicators to calculate measures of capacity and complexity. Taking countries as a starting point, each country's attainment across all 75 indicators is summed up to produce a first order measure of a country's capacity. The same can be done for the indicators from which the sum of the links for any indicator represents the overall attainment of the indicator given the set of countries. However, this in itself is not very enlightening in that the measure is the simple sum of attainment. The Method of Reflections allows for iteration by using the information collected at the first order measure to calculate a second order measure, and so forth until higher order measures are calculated. For example, the second order measure for countries would not simply sum the links, but would weight those links based on the values for the indicators calculated in the first order. Higher reflections for countries represent generalized measures of "unobserved capacities" in that the difficulty in achieving a certain level in a particular indicator is taken into consideration, rather than simply summing up the raw attainment levels. The same applies for indicators, in which the higher order reflections generate generalized measures of "complexity" in that the unobserved capacities of countries are taken into consideration.

For this analysis 75 indicators are further disaggregated into 100 different categories, each resulting in a total of 7,500 indicators. The indicators are disaggregated by dividing the attainment of countries in any indicator into 100 groups, and dichotomizing the attainment. For example, a country that is in the bottom 1 per cent with regard to the poverty indicator will score a 1 in the first of the 100 poverty

indicator categories, and a 0 for all subsequent categories. A country that is in the top 1 per cent will record a score of 1 for all 100 of the poverty indicator categories. The reasoning behind this disaggregation is that for the bottom categories, many countries will have a score of 1, which will result in that bottom category having a low "complexity" score, while the top category will have very few countries having a score of 1, resulting in a high "complexity" score. Thus, disaggregation allows for the differentiation of countries' attainment into separate "complexity" categories for each indicator.