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Concretizing Green Growth and Sustainable Business Models in the Water Sector of Jordan

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Received: 7 April 2019; Accepted: 7 May 2019; Published: 10 May 2019

Abstract: The green growth paradigm has gained much attention from various governments worldwide as a guiding strategy for national and sectoral growth strategies. There is, however, little knowledge on how to integrate green growth into key natural resource sectors, such as water. This paper explains the origins and underlying concepts of green growth, and assesses its potential in the Jordanian water sector. Using a green growth diagnostic model, we analyze six key industries in the Jordanian water sector that can be an engine for green growth and the achievement of key sector-related Sustainable Development Goals (SDGs). In addition, four innovative business models are presented which exemplify the best practices and future directions of the water sector in Jordan. The results and recommendations support the strategic decision-making process of linking economic growth and sustainability, and encouraging private investments.

Keywords: green growth; SDGs; Jordan; water sector; national economic strategy; business models

1. Introduction

In recent years, several paradigms have emerged in the international arena as a response to the pressing global challenges of resource depletion, climate change, and environmental degradation. Green growth represents one of the most prominent sustainability debates that promises to harmonize economic growth with environmental sustainability [1]. Such debates also include paradigms such as cleaner production, bioeconomy, or circular economy [2]. Green growth is also promoted by international organizations such as the Organization for Economic Co-operation and Development (OECD) [3,4]. In fact, the conceptualization of green growth has been analyzed by several authors highlighting the various underlying theories and concepts, which allow for different degrees of substitutability between growth and environmental sustainability (e.g., strong and weak sustainability concepts and other concepts from environmental and ecological economics) [2,5]. Further, several studies have highlighted the critical role of business models in the transition to green growth. These business models involve both large and small firms exploiting technological and business opportunities to create an economic value that does not harm the environment [6,7]. They create green solutions and products through improved resource efficiency and innovations that create a balance between environmental (e.g., low waste and emissions, no pollution) and economic (e.g., profitability, job creation) objectives [8–10].

In this sense, highlighting business- and industry-based components of green growth in measurement tools is seen as an adequate approach to generating relevant knowledge in this field. Therefore, several studies have sought to operationalize the idea of green growth using indicators

developed by international organizations (e.g., applications of the green growth diagnostics tools provided by the OECD) [11–13]. Other studies have developed key green growth indicators for integrating different sectors (e.g., water, energy, climate soil) [14], incorporating resource use boundaries on a country-level into the measurement of green growth [15], or breaking down the green economy idea into the reality of a certain sector, such as energy [16]. A review of green growth indicators is provided by Georgeson et al. [17], who recommended to provide measures beyond Gross Domestic Product (GDP) and develop alternative methodologies and measurements of green growth. In this context, this paper provides a novel, conceptually-driven diagnostics tool of green growth by exploring the links between green growth, innovations, business models, and sustainable development. The aim is to apply this tool for evaluating the role of key industries and business models in achieving green growth in the policies of vital sectors, such as the water sector. The developed green growth diagnostics can serve as a simple tool to identify key aspects of green growth in a particular sector. In this sense, the paper advances literature on green growth measurement, sustainable business models, and sector-driven sustainability strategies.

For over a decade, economy-wide green growth strategies have been used by many countries, while sectoral green growth strategies are still not common. Although the notion of green growth has been around for decades [18], the idea attracted significant attention particularly in the aftermath of the global financial crisis of 2008. At that time, green growth was seen as a viable strategy for the environmental sector as a potential growth sector through attracting new investment opportunities, and establishing new industries that also contribute to the idea of sustainability [19]. It gained more importance in light of the failure of the Copenhagen Conference in 2009, as countries and activists started to embrace the idea of pursuing clean technologies in a "green race" to encourage a low-carbon economy and achieve leadership in the supply of resource-efficient technologies [20]. Later, the green growth idea became the "distinguishing theme" of the Rio+20 conference in 2012, which adopted green economy guidelines to achieve green growth as a tool for sustainable development [21]. Since then, green growth has been critically reviewed with regard to its role of promoting neoliberal capitalism [22–24]. Furthermore, in the context of the global south and poor countries, green growth needs to accommodate the complex socio-economic processes related to poverty, address structural imbalances, and be embedded within social welfare and poverty-reduction policies [25–28]. Nevertheless, green growth has remained a strong guiding paradigm, which many countries including South Africa [29], South Korea [30], Jordan, Kenya, and others, have sought to integrate into national strategies. As a key instrument for promoting green growth, business-driven "green" or "ecological" innovations" can induce growth and employment [31–33], and achieve resource efficiency or decoupling [6,34].

Alongside economy-wide green growth diagnostics, the sector-specific assessments of green growth have been mainly related to the issue of energy and climate change [16,35]. Until now, there has been no comprehensive assessment of how to translate green growth into policies related to natural resources. Furthermore, the conceptualization of green growth and Sustainable Development Goals (SDGs), and their impact on national sector strategies, is still weak. There is also a necessity to diagnose green growth strategies in arid countries, and to provide required insights into steps of action for green growth and SDG implementation in various sectors. To this end, in this study, we provide a unique assessment of green growth in the water sector in Jordan. Jordan is an interesting case in point as it has developed a national green growth plan with the support of donors, and therefore has shown a willingness to move towards a green economy and pursue green growth while achieving the SDGs [36]. In the arid region of the Middle East and North Africa (MENA), Jordan and the United Arab Emirates are the only few examples of the development of comprehensive green growth strategies [36,37], while some scattered green growth activities exist in other countries, particularly in North Africa (e.g., Morocco and Egypt) [38]. The focus of this paper is to assess green growth potential in the water sector, a vital sector for the water-scarce country of Jordan, as will be explained later.

2. Conceptual Foundations

2.1. Green Growth, Industries, and Business Models

In this section, a comprehensive definition of green growth will be presented based on a review of its constituent elements according to academic literature and operationalizations by key international organizations such as the OECD, the World Bank, and the 2010-founded Global Green Growth Institute (GGGI). Engelmann and Al-Saidi [33] analyzed the emergence of the green growth paradigm in environmental policy and the key role of industries and business models in this paradigm. They also reviewed definitions and criticism of green growth. In this paper, we base our definition on this work by Engelmann and Al-Saidi [33]. We understand green growth as a sustainability paradigm that purposefully promotes industries and business models that represent viable future eco-innovations, and effectively decouples resource use from economic growth in order to contribute to a sustainable, low-carbon economy. This definition lays the foundation for the development of our green growth diagnostics tool, which assesses the extent and potential of green growth implementation using a comprehensive set of indicators.

The focus on businesses and industries in green growth strategies is motivated by their central role in achieving an economic added value in any growth process, including one that takes environmental sustainability into account [3,33]. According to the idea of green growth, businesses are required to use eco-innovations (i.e., inventions of processes, technologies, or business models that results in environmental benefits along the value chain) [39]. Innovative ideas and business models are needed to ensure economic benefits and serve as incentives for companies to invest and implement green growth principles. In order to depart from the traditional, resource-intensive economic model, which implies a "growing first, cleaning up later" mentality [40], ecological considerations and environmental protection have to stand at the core of any future business models and industrial set-ups. This is because natural resources are largely at risk, especially water resources, and consequently need to be preserved for the future. While business and industries that contribute to growth are often in private hands in many countries, ownership is not defined ex ante by the green growth concept, and therefore public-owned companies or state-dominated industries are not excluded. This notion is important for the water sector, which is often characterized by the strong involvement of states. While green growth strategies seem to have a bias towards the private sector to stimulate eco-innovations [33], this might be due to the fact that, from a macro-level, private businesses are constituting the bulk of economic activities. For this paper, we use our criteria for green growth to evaluate the plans to create products and operate (business models) in the water sector regardless of ownership (i.e., whether by private companies, public corporations, or other forms of business organization).

The earlier-mentioned definition of green growth puts business models in the center, and lays out three criteria, namely the use of eco-innovations, decoupling and resource efficiency, and low carbon production. These elements are analyzed in detail in Engelmann and Al-Saidi [33]. Some criteria are specifically analyzed in literature. For example, an increase in resource efficiency and decoupling was emphasized as a key element to accomplishing green growth [6,41,42]. In general, efficiency means the most optimized way of using resources for production and represents a prerequisite for achieving welfare without waste. The green growth paradigm stresses that resource use should be efficient and lead to a decoupling of economic growth from the use of vulnerable natural resources [43]. Furthermore, the low carbon impact of economic production is another crucial parameter when it comes to green growth. In line with the Paris Agreement to limit global warming to well below 2 °C in this century [44], reducing the carbon footprint in the countries' economies is essential for growth that does not damage the environment and the climate.

The criterion of eco-innovation utilization is a special case here. Compared to the other criteria, it is rather a means to achieving the other aspects of green growth, and not a goal in itself. However, eco-innovation utilization is a central theme and constituent element of green growth debates, and was therefore included in the diagnostics tool. It is hard to fulfil the other criteria if eco-innovations are not

utilized, and must thus be considered when analyzing industries and business models. It is important to note that eco-innovations must not necessarily be of a technological nature, but may also include process innovations, such as introducing new product lifecycles.

Alongside the three core criteria of green economy, we extended our analysis to include another three criteria associated with the "traditional" understanding of sustainable development, namely economic added value, environmental protection, and social equity. There are two reasons for this extended view of green economy. First, in the definitions of green economy, this concept is often referred to as a "tool" or an "operationalization strategy" of sustainable development [33]. Therefore, we believe this concept should be understood within the framework of sustainable development, and thus incorporate the three additional criteria which remain the only globally recognized components of sustainable development. Second, literature on green growth often criticizes the lack of emphasis on social aspects or environmental protection in general, and while some scholars demand green growth to become more inclusive (e.g., [42]), Krämer and Herrndorf [45] argue that it would otherwise be too short-sighted to exclude social goals from green growth strategies. The social equity dimension is mostly included as far as employment is concerned [34] while sometimes equity and poverty reduction are also considered. The economic added value criteria is understood in this paper as the ability of an industry or a business model to contribute to increasing economic growth and sustained production activities in the long-term (e.g., profitable businesses or industries exhibiting comparative advantages). Figure 1 summarizes the pillars of our green growth diagnostics as a reflection of an extended understanding of sustainable development.

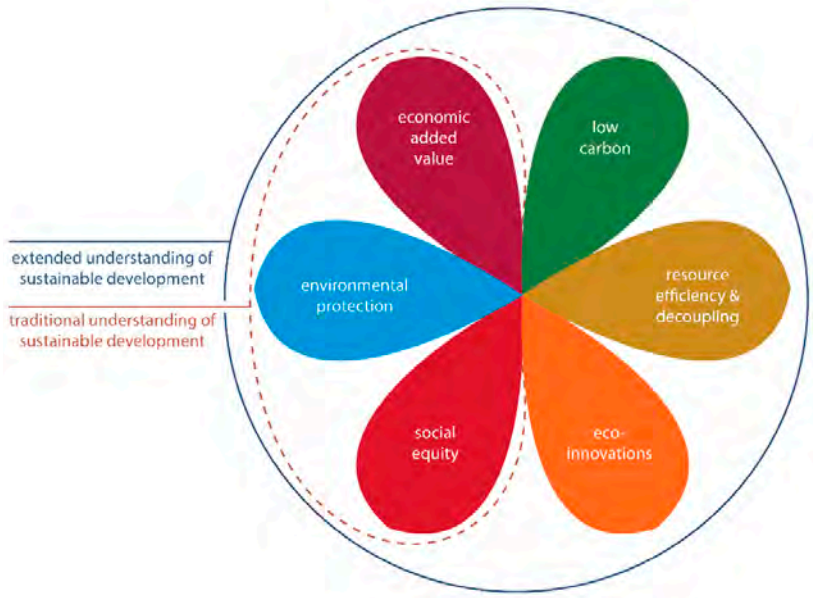

Figure 1. Green growth and the Sustainable Development Goals.

2.2. Contextualization of Green Growth

Green growth is not a uniquely accepted idea and has been criticized for repackaging sustainability, overemphasizing the economic–environmental links over social equity, and having overlaps to other concepts such as degrowth, circular economy, bioeconomy, or low-carbon economy (for more on green growth criticism, see [2,33,34]). For example, for Jakob and Edenhofer [27], green growth seems in opposite direction to the degrowth idea of slowing economic growth, but both ideas fail to conceptualize social welfare. In fact, green economy or green growth has indeed been framed by governments and the private sector as a way to support businesses to create green jobs and become more environmentally aware [46]. It has therefore an inherent bias towards the producing industry, while it exhibits many influences from neighboring concepts. For example, the idea of circular economy of using technical and biological materials from one production and consumption into the same or

another process is reflected in the eco-innovation concept of green growth. In fact, green economy can be understood as an umbrella concept which includes elements from circular economy or bioeconomy, the latter focusing on biological, resource-based innovation, and sustainable land-use practices [47]. In the scope of this paper, it is not possible to explain the overlaps between green economy and other concepts, as well as the conceptual origins of green growth. Such a detailed study is provided by Loiseau et al. [2], who regard green economy as an umbrella concept lacking operationalization while other concepts act as a heuristic framework for defining it.

Further, we contextualize the green economy concept within the framework of the Sustainable Development Goals (SDGs). The SDGs were adopted a few years after green growth by the UN General Assembly in 2015, and are the successors of the Millennium Development Goals (MDGs). The set of 17 aspirational goals with 169 targets covers a wide range of issues, while green growth is particularly represented in Goal 8, "Decent work and economic growth", and especially in Target 8.4: "Ensure global resource efficiency and decouple economic growth from environmental degradation". However, resource efficiency and decoupling are only two pillars often associated with green growth; the literature includes broader objectives and means, constituting a holistic understanding of green growth.

Figure 2 depicts an analysis of the overlaps of the SDGs with the six pillars of our green growth understanding. It shows that the implementation of green growth strongly supports the success of the Sustainable Development Goals. The SDGs represent the most comprehensive understanding of sustainable development. They expand the green growth pillars by the issues of good governance and partnerships—which represent key priorities, especially for many developing countries—as well as the issue of equality, a key contemporary challenge associated with growth, globalization, and modernization. In this sense, the SDGs exhibit a socio-environmental focus in comparison to the economic-environmental orientation of green growth.

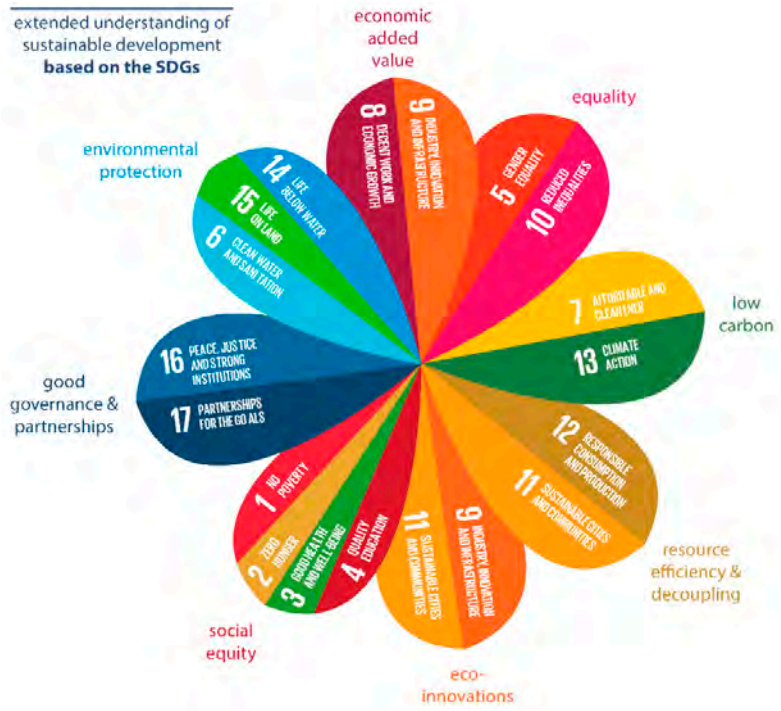

Figure 2. Green growth and the Sustainable Development Goals.

3. Case Study—Jordan's Water Sector

3.1. Water Sector Challenges

The Hashemite Kingdom of Jordan has a substantial potential for green growth, but at the same time, is facing acute economic and environmental challenges. The rapidly growing population is

expected to double by 2050 [48], which will increase the pressure on natural resources and infrastructure. Jordan is one of the most water-scarce countries in the world with a water deficit that reached more than 400 Million Cubic Meters (MCM) per year in 2015 [48]. A decrease of 20% in annual precipitation over the last few decades coupled with inefficient use of water has exacerbated the stress of Jordan's water resources, resulting in severe water shortages and water systems degradation [48,49]. Jordan is also classified as a highly vulnerable country to climate change impacts, especially due to fact that its ecosystem productivity strongly depends on the hydrological cycle (see [50–52]). Energy access and security is another field of concern, as 97% of energy is imported [53].

This imbalance between supply and demand can be attributed to scarce natural water resources, recurring droughts, overconsumption of water, and distribution losses in the network. For example, non-revenue water is a big issue in Jordan, since more than 50% of the supplied water is wasted due to physical and administrative losses, as well as illegal connections [54]. The scarcity of water resources eventually results in an intermittent supply of water that is delivered only once or twice a week, and consequently needs to be rationed by the end users who also have to pay higher prices for private water tankers [55]. The water problem of Jordan is aggravated by mismanagement, a rentier mentality in providing water services, and a shadow state that resists any substantial reforms to the status quo (e.g., [56,57]). Facing these multiple water challenges, Jordan has started to initiate reforms whether in the area of redesigning subsidies, water prices and the level of service provision (decentralization) [55], or in the area of improving the overall planning of resource management and finding alternative water sources such as treated wastewater [58].

On the green growth agenda, the water sector of Jordan is a good case since it has some potential that can be utilized within the government's push to implement green growth strategies. First, the difficult hydrological and physical preconditions (e.g., big elevation differences, high costs of transporting water from source to cities) make cost- and resource-efficient technologies and processes even more pressing and can fuel innovation in this sector. Second, Jordan with its "vast tracks of sun-bleached and windswept land" [36] holds a good potential for renewable energy generation, especially in solar and wind energy, but also in biogas production, to provide reliable and clean energy for water supply. Renewables are highly needed to decrease the energy dependence on neighboring countries and to decrease the energy subsidy cost for the water sector. Third, the refugee crisis puts strain on the local economy, but offers some opportunities as well. Donor organizations are eager to support Jordan in handling the large number of refugees in the kingdom and therefore want to invest in the development of the infrastructure and the national economy since Jordan is one of the few stable countries in an instable region. In fact, donor involvement in the water sector has been very high in the past and has significantly contributed to framing the discourses about water mismanagement and the need for reforms [59]. Additionally, the government has shown willingness to prioritize the water sector, stating water scarcity as "one of the biggest barriers to our economic growth and development" [49]. While the political reality of patronage and mismanagement are threatening such a commitment, there are opportunities to frame the needed change within larger economic strategies such as that of green economy. For this, it is necessary to examine the trajectory of the green growth debate in Jordan and identify models to incorporate this agenda in the water sector.

3.2. Green Growth Trajectory

As one of the first countries in the MENA region, the government of Jordan made a crucial decision in 2010 to launch the Green Economy Initiative [60]. Consequently, Jordan has initiated measures to assess its green growth potentials and establish a framework for moving towards green and sustainable growth. Figure 3 gives an overview of the milestones of the green growth development progress in Jordan since 2010.

The Jordanian government already has a comprehensive policy framework in place, and the different ministries have published various strategies concerning water, climate change, and energy. Table 1 summarizes the existing governmental strategies and policies with an outline of the key points

and their relevance for green growth. So far, Jordan has released two documents that specifically deal with green growth and prepare the way for subsequent actions. The Ministry of Environment (MoEnv), as the key actor in this, laid the foundation with the Scoping Study and recently delivered the National Green Growth Plan (NGGP), a more concrete framework for green growth in Jordan. Both look at cross-sectoral issues and have water as one aspect among others. The National Water Strategy of Jordan was updated in 2016, and was linked to the SDGs. It sets objectives for the water sector that support the achievement of water-related targets and promote the optimized utilization of the interlinked resources of water, energy, and food. To realize this, the Ministry of Water and Irrigation (MWI) is in the process of developing a National Water Information System (NWIS) to monitor and track the progress [48].

Table 1. Selection of national strategies and policies in Jordan related to green growth and the Sustainable Development Goals (SDGs).

	Document Name	Year	Source	Description and Main Points	Relevance to Green Growth
Green growth-specific strategies	Towards a Green Economy in Jordan	2011	MoEnv and UNEP	Scoping Study to assess potential for green growth implementation.	First key document for transition towards a green economy and to foster green growth.
	National Green Growth Plan for Jordan (NGGP)	2017	MoEnv and GGGI	Roadmap to a gradual transition into green growth. Builds upon existing government strategies (e.g., Vision 2025).	Identifies green growth opportunities and key performance indicators. Designs a cross-sectoral green growth policy framework and implementation plan.
Climate strategies	National Climate Change Policy of the Hashemite Kingdom of Jordan 2013–2020	2013	MoEnv	First of its kind in the MENA region with wide objectives such as capacity, resilience of ecosystems, and mitigation.	Mentions mainstreaming green growth policies for climate change mitigation. Aims at reducing carbon emissions.
	Jordan's Intended Nationally Determined Contribution (INDC) to the Paris Agreement	2015	Government of Jordan (GoJ)	Aims to reduce GHG emissions by 14% in 2030: 1.5% by Jordan's own means, and 12.5% by 2030 (subject to availability of foreign financial aid).	Crucial goals for a transition towards a low-carbon economy. INDC measures are key elements of the NGGP. Calls for the private and financial sector to realize green growth opportunities.
Water sector strategies and policies strategies	Establishing the Post-2015 Development Agenda: SDGs Towards Water Security	2014	MWI	Offers situation analysis of the water sector. Revises good progress of MDGs in Jordan.	Does not give clear targets towards SDG or green growth implementation
	National Water Strategy 2016–2025	2015	MWI	Action plan with objectives for the water sector. Provides initial response to Jordan's commitment to the SDGs.	Green growth is not directly mentioned, but indirectly supports green growth objectives (e.g., through wastewater re-use, and reallocation measures).
	Water Sector Capital Investment Plan	2016	MWI	Lists a broad range of infrastructure investments as well as economic and financial criteria for priorities (e.g., reducing NRW, enhancing energy efficiency).	Supports green growth objectives of increased resource efficiency, decoupling, and wastewater re-use.
	Climate Change Policy for a Resilient Water Sector	2016	MWI	Aims to strengthen climate change resilience of the Jordanian water sector, based on IWRM approaches. Emphasizes implementation of SDGs.	Highlights the opportunity to focus on climate change adaptation to make Jordan a leader in climate-resilient green growth.
	Energy Efficiency and Renewable Energy Policy in the Water Sector	2016	MWI	Aims at reducing the total energy consumption in water facilities by 15%, and at increasing the share of RE to 10% of overall energy used in the water sector.	Supports the goal of GHG emission reduction in the water sector, cost-recovery, and improved resource efficiency. Combined effect of measures would reduce CO_2 emissions by 0.79 kg/m^3 of billed water.

The analysis of the governmental policies and strategies shows that until now the green growth concept has mainly been promoted by the MoEnv. This is expressed, for example, in the documents that deal with climate change issues. The need for green growth measures to reduce the strain on the environment is cited several times, and is mainly expressed in its call for carbon-emission reduction

by various sectors, including the water sector, which releases more than 1 million tons of CO_2 each year [53]. The localization of green growth at the MoEnv is also manifested by having a Green Economy Unit at the ministry, and by the close collaboration with the GGGI. It can be seen as the key driver for green growth in Jordan. The Ministry for Energy and Mineral Resources (MEMR) has started to push for an increase in renewable energies, while not mentioning green growth as a guiding principle. The same applies for the Ministry of Water and Irrigation (MWI) where green growth does not play a major role as a paradigm. Most of the new documents of the MWI do not mention green growth directly; however, many of the proposed goals and actions indirectly support green growth objectives, such as resource efficiency, cost recovery, carbon reduction, and protection of ecosystems. This is either due to the novelty of the concept, which still lacks understanding among the stakeholders, or because its potential for the water sector has not yet been identified.

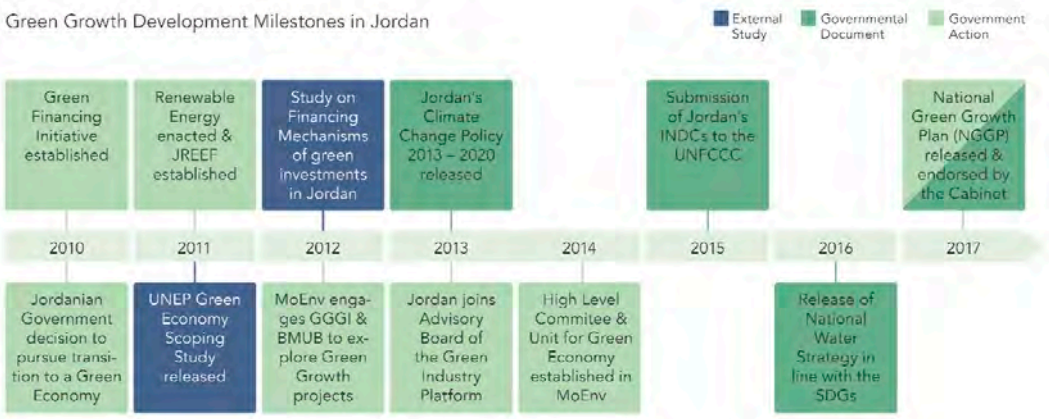

Figure 3. Green growth development milestones in Jordan.

4. Methodology: Green Growth Diagnostics

4.1. Diagnostics Usefulness, Layout, and Indicators

The bulk of literature has focused on defining green growth and identifying the potentials of green growth in general or for a specific country (for an overview, see [17,33]). Current green growth research also deals with questions of technology and innovation, sustainable economic growth, green jobs, and metrics to measure green growth performance. However, there is a need to operationalize green economy despite its complex conceptual nature elaborated on in the second section. There exists several indicator-based assessments in the form of macroeconomic diagnostics or indices (see the overview of indicators in [17]). A notable contribution was that of the Organization for Economic Cooperation and Development (OECD) which issued several publications on how to measure green growth and developed tools to deliver green growth (for an overview see [3]). For example, OECD's Green Growth Diagnostics is a simple flow of steps using a set of social and economic indicators in order to identify policy options and simulate growth impacts. This approach is based on the work of Hausmann et al. [61] and has been applied in, for example, South Korea for assessing green growth strategies [12], or in African countries for identifying binding constraints to private investment in clean energy [62]. A similar macroeconomic approach is presented by the Global Green Economy Index of Dual Citizen LLC. This index measures the performance of countries on green growth using several qualitative and quantitative indicators (e.g., investment attractiveness, innovation potential, climate change, energy, transport, resource efficiency, renewables, or green investments) [63].

Indicator-based approaches to diagnosis green growth help approximate the performance of current policies on green growth and identify gaps through comparisons to other countries or an in-depth analysis of single countries. The idea is not to provide exact measurements of the manifestation of the idea of green growth, but rather a structured method to investigate green growth case studies or identify best practices. Some scholars criticize the use and usefulness of macroeconomic diagnostic

methods since they do not provide insights on the level of specific industries or sectors [64]. In fact, there is little research on how to break down the idea of green growth to this level, except for few studies on energy and climate change related issues [16,35]. For the water sector, we found an index developed by a consortium between stakeholders from the Republic of Korea and the World Water Council (WWC). The Water and Green Growth Index (WGGI) offers a variety of quantitative environmental, economic, and social indicators from studying best practices in examined case studies, although it was not thoroughly applied on the cases [65].

In fact, data availability and reliability is a major constraint for green growth diagnostics at sectoral or industrial levels. In order to solve, this paper relied on theoretically founded criteria, qualitative data, and expert input in analyzing green growth best practices in the Jordanian water sector. The developed green growth diagnostics is conceptually based on the six criteria explained in Section 2. Figure 4 provides an overview of criteria category, indicators, and their classification. This diagnostics framework had two uses during this research. First, it helped define the green growth idea for non-expert (on green growth) key informants during the process of identifying key industries exhibiting the green growth idea (see Section 4.2). Second, it served for assessing the key industries in terms of strengths, weaknesses, and potentials. We did not rank industries using this diagnostics nor did we include a weighting of the criteria categories. In fact, a weighting of categories is not common in these approaches as this can be done ex post if policymakers prioritize specific policy objectives. The usefulness of such a diagnostics is to provide a method of prioritization and evaluate concrete examples of businesses embodying the green growth idea. The diagnostics is applied on industrial examples that have been identified using key informants' interviews (see Section 4.2).

CRITERIA	CLASSIFICATION ▸ / GUIDE INDICATOR ▾	HIGH	MODERATE	LOW
Low Carbon	A: Use of renewable energies (RE)	Various applications of RE possible and already in use	Feasible applications of RE	Rare applications of RE
	B: Production of renewable energies	Various types of RE production (solar-, hydro-power, biogas, etc.)	One type of RE produced	No production of RE
	C: Potential for energy use reduction	Energy use reduction potential of more than 20%	Energy use reduction potential of 10-20%	Energy use reduction potential minimal.
Resource efficiency and decoupling	A: Production of technologies for water use-efficiency	Extensive production of water-efficient technologies	Modest production of water-efficient technologies	Little production of water-efficient technologies
	B: Application of water efficient technology	Various applications of technologies possible and already in use	Feasible applications of new technologies	Rare applications of new technologies
	C: Recycle and re-use of water	80-100% of water in use is recycled	50-80% of water used is recycled	Up to 50% of water used is recycled
Eco-innovation utilization	A: Application of technical and non-technical innovation	Various applications of technical and non-technical innovation	Feasible applications of technical and non-technical innovation	Rare applications of technical and non-technical innovation
	B: Potential of intellectual property	High potential for industrial patents and IP innovations	Patents and IP are feasible	Patents and IP are rarely produced
	C: Potential for 'first-mover' advantages	Market is not saturated. High potential for defining new products and capturing emerging markets	Market is moderately saturated. A number of companies exist	Relative market saturation. High diversity of companies on the market
Economic added value	A: Significant potential for growth and profitability outlook	Significant potential for growth and high profitability potential	Moderate growth and profitability potential	Little potential for growth and rather low profitability potential
	B: Potential for comparative advantage	High potential for comparative advantage	Comparative advantage is feasible	Comparative advantage is difficult to achieve
	C: High demand of product / big market size	Market is large and product is in high demand	Market size can expand and product is in demand	Limited market size and product is infrequently demanded
Environmental protection	A: Low waste production	Recycling mechanisms are in place and waste production is limited	Recycling mechanisms can be implemented. Moderate waste production	High waste production with no recycling mechanisms in place
	B: Avoidance of non-compensable risks	Risk prevention guidelines and mechanisms are well integrated	Risk prevention guidelines and mechanisms are mentioned	No risk prevention guidelines and mechanisms in place
	C: Conservation of ecosystems	Various strategies and initiatives to conserve ecosystems play a key role	Strategies and initiatives to conserve ecosystems are mentioned	Strategies and initiatives to conserve ecosystems are not considered
Social Responsibility	A: Job creation potential	High number of new jobs can be created	Job creation is possible	Almost no jobs are created
	B: Low Job market access barriers	Job market is easily accessible	Job market is accessible with some barriers	Job market is difficult to be accessed
	C: Congruence with public social policies	Public social policies are explicitly referred to	Congruence with public social policies is visible	Public social policies are ignored

Figure 4. Green growth criteria and indicator classification.

The indicators in each category were developed based on lead issues discussed in literature to achieve the essence of criteria in the categories (see the review of the green growth contents in [2,33]). These lead issues are: renewables for the low-carbon category, water efficiency and reuse for the resource efficiency and decoupling category, marketable innovation for the eco-innovations category, profitability for the economic added value category, ecosystems' protection for the environmental protection category, and job creation for the social equity category. The resulting indicator list is comprehensive, but not exhaustive and some interdependencies still exist. However, such interdependencies cannot be eliminated in such a conceptual exercise. The development of the indicators and the scoring guideline was carried out in a focus group of researchers on Jordan from within the German-Arab master program at the TH-Köln, University of Applied Sciences in Germany. The focus group also carried out the scoring on the pre-identified industries after the field visit to Jordan and the collection of qualitative data in the same year.

4.2. Data for Industries and Business Models

For the identification of key industries and business models, a field research to Jordan was carried out between January and March of 2017. During this, qualitative data on the water sector was collected while extended, semi-structured interviews with 10 experts (3 from the government, 3 from international organizations, 2 from the private sector, and 2 academics) were carried out. The experts involved some of the staff developing the national green growth strategies, but also people from the water sector not working on green growth. All key informants were asked to indicate which industries (whether public or private) play a major role in green growth implementation and to provide concrete industrial examples from their point of view. Data on collected, water-related industries and industrial examples indicated as bearers of green growth potentials were gathered and field visits to some projects and plants were organized. The resulting key industries and industrial examples in Section 5 represent the consolidated descriptions based on experts' input and collected data during the field visits. More detailed descriptions of the key industries, including examples, were produced after the field visits and constituted the basic materials used for the earlier described scoring of key industries by the focus group using the green growth diagnostics.

5. Results

5.1. Priority Industries

We looked at key industries and green business models in the water sector that can be an engine for green growth and the implementation of the SDGs. This chosen focus on industries and business models corresponds to the statement of the Jordanian Executive Development Programme that called for the launch of a program for green services and industries [66]. Figure 5 shows the relevant water-related industries with regard to their relationship to the core water and energy sectors. Not all of the identified industries address core functions of the water sector, and some are cross-sectoral. The water utilities (currently only four exist in Jordan) did not figure as industrial examples exhibiting green growth since they were seen not to show an innovation potential or promote efficient and green technologies. However, some of the industrial examples (e.g., wastewater treatment plants), are relevant to the operations of these utilities. The industries are explained in Table 2, indicating examples of products and business models.

Using the green growth diagnostics tool, we compared the industries in order to show differences in their green growth potential. Figure 6 summarizes the comparison of the results using our diagnostics tool. Wastewater treatment, independent water and power producers (IWPPs), and energy-efficiency solutions for water supply attain the highest score, with only two having "low" categorization. The first two industries are close to the central sector functions of supplying water (and energy), and score especially high in resource efficiency and low-carbon potential. The water information technology (IT) industry was found to be the only one with high classification for "first-mover" advantages

where investments would be well-targeted, since the market is not saturated yet. Water consulting scores high on environmental protection and economic added value, but rather moderate in the other categories. Water infrastructure scores moderate on "low carbon" and "environmental protection", but shows good potential in social aspects, such as job creation, and has a high profitability outlook and high demand for its products and services. In general, the categories of "economic added value", "environmental protection", and "eco-innovation utilization" get high scores in total, which represents the core idea of green growth and a means to achieving it. Furthermore, the highest classification in the indicators of "production of water-efficient technologies", "application of (non-) technical innovations" and "potential for growth and profitability outlook" are fulfilled by almost all of the industries.

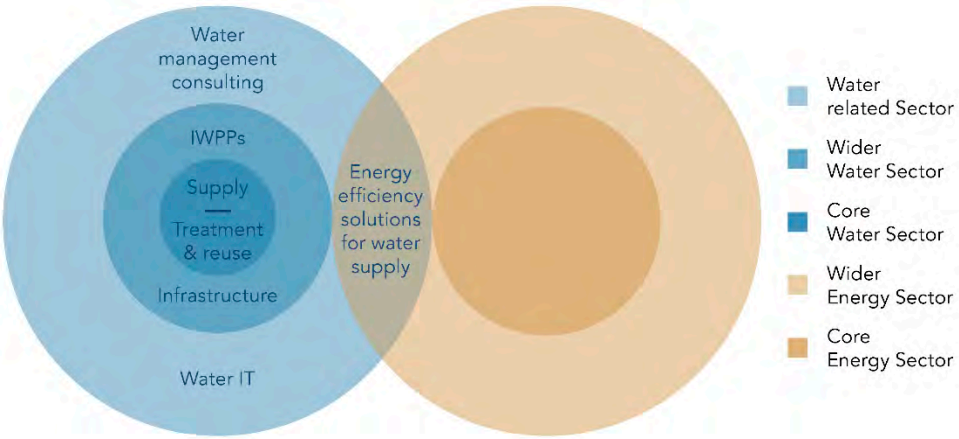

Figure 5. Key industries in the water sector.

Table 2. Key industries in the water sector and related examples.

Industry	Explanation	Industrial Examples
Wastewater treatment and re-use	Recycling and re-use for irrigation, groundwater recharge, industrial, or domestic supply Opportunity for reducing energy and carbon footprints of water supply and preventing pollution of groundwater resources	Centralized wastewater treatment plants (WWTP) Decentralized greywater treatment technologies
Independent water and power producers (IWPP)	Private entities that generate freshwater and energy to sell their output to public utilities and end users. Organized often as public–private partnerships (PPP) (e.g., BOT-contracts).	Desalination plants Thermal power plants Biogas from sludge (in WWTPs) Hydropower generation from dams
Energy efficiency solutions for water supply	Companies providing energy-efficient technologies and services. Reducing the use of fossil fuels, carbon emissions, leakages, and environmental impacts Financial savings over mid- and long-term	Energy-efficient pumping equipment Water cooling and heating (residential, commercial, governmental)
Water IT	Firms providing software, analytics, and automation of processes Aim to examine, design, manage, and optimize water and wastewater systems. Utilities and large water consumers (e.g., the paper industry) as clients	SCADA technology Wireless monitoring equipment Sensors and smart customer metering
Water infrastructure and construction	Infrastructure construction and maintenance services Rehabilitating physical losses in the network Build infrastructure (e.g., WWTP, canals, pipelines)	Engineering companies and consultancies
Water management consulting	Companies that offer consulting services on water management (e.g., water audits) Consultants with know-how in sustainable solutions and skills in water management, and who are familiar with the principles of green growth	Environmental consultancy firms

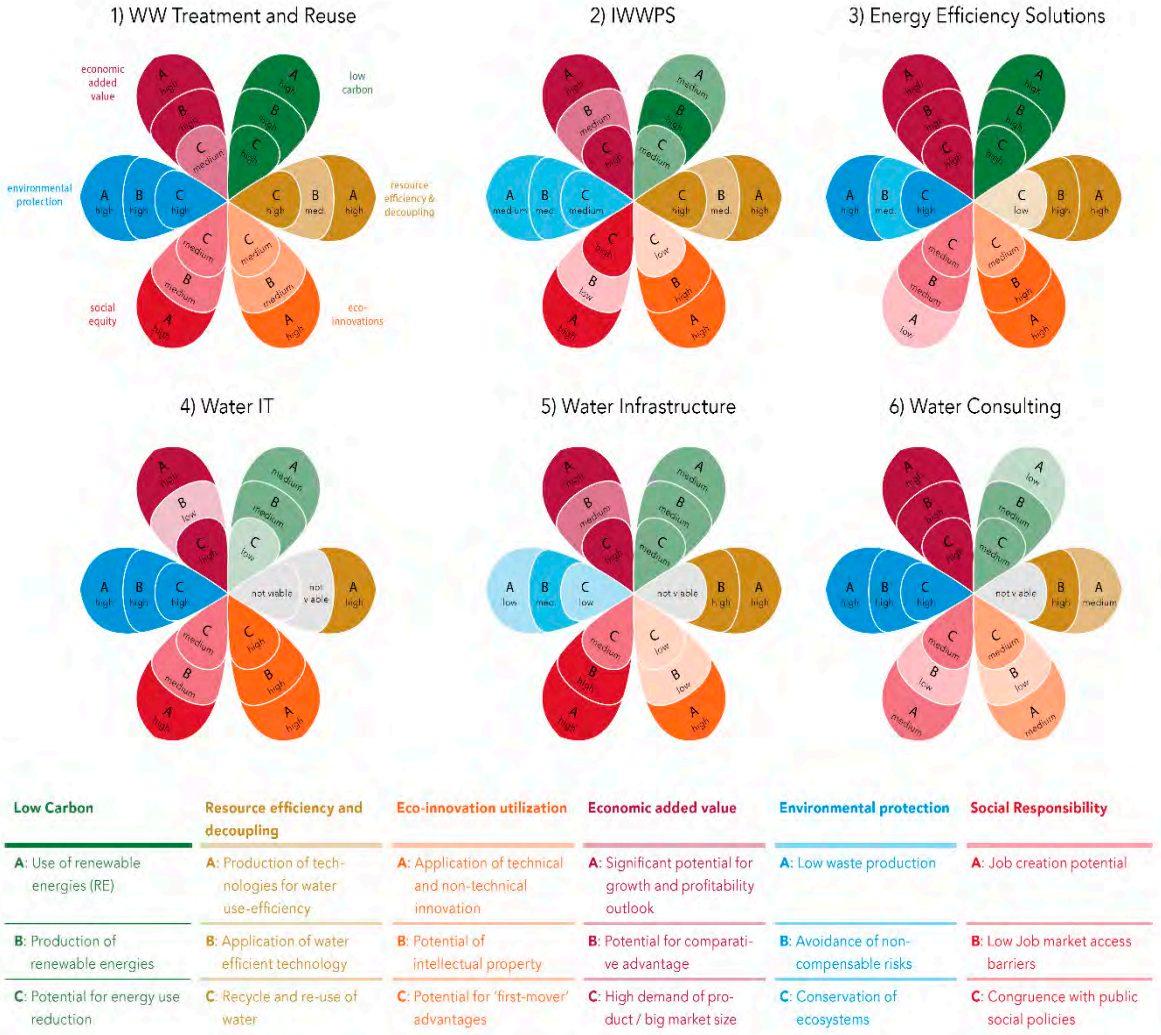

Figure 6. Results of diagnostics tool application on key industries.

5.2. Examples of Business Models

After the key industries have been outlined and compared, we now highlight some green business models as best practices of green growth in the water sector. Four exemplary business models were chosen from the Jordanian context and are not in all cases private or profit-oriented. In fact, these models are plans to operate and create value that can be manifested in the future within larger industries exhibiting different operational purposes or organizational designs. In the following, we provide short descriptions of the potential industry and elaborate on the exemplary business models.

5.2.1. Business Model 1: Khirbit As-Samra Wastewater Treatment Plant (WWTP)

The re-use of wastewater represents an attractive option for augmenting supply in a water-scarce region, but also for improving the well-being of the environment and ecosystems by reducing carbon footprint and the exposure of the environment, and eventually human beings, to pollutants. Jordan has already accumulated important know-how in this field, and has a supporting policy framework to expand and optimize its wastewater treatment [67]. Different options (such as decentralized or centralized units, and production of renewable energies) promise an attractive market for private companies to sell the treatment technology and offer installation and maintenance services to clients.

One good business example is "Khirbit As-Samra" in north-eastern Jordan. The largest WWTP in the country treats more than 70% of the wastewater in Jordan. This equates to 110 MCM of water produced per annum, which contributed to the restoration of the Zarqa River, and is further reused for

agricultural irrigation. Moreover, the plant is 80%–90% energy self-sufficient by producing 230,000 kWh of renewable energy per day through biogas production and hydro-energy within the facility. A total of 30% of the plant's energy demands are met though hydraulic turbines utilizing the elevation differences between cities and the plant, as well as the plant and the outlet, while the other regained energy stems from the conversion of organic matter into biogas (methane and carbon dioxide) [68]. This saves up to 300,000 tons of CO_2 every year [69]. As a result, it benefits not only the environment but also the people, as it provides large amounts of good-quality water, while local people are employed and trained to expand their expertise. This plant has gained much recognition for its contributions in combating climate change, increasing water reuse for agricultural purposes in the Jordan Valley, and meeting treated wastewater reuse standards in Jordan for purposes such as landscaping in cities, cooked vegetables, and parks [70]. By using the recovered energy, the plant is also considered as a prime example of business models in the MENA region in the intersection of the water and energy sectors [68].

5.2.2. Business Model 2: Aqaba Desalination Unit

IWPPs can be private entities or organized through public–private partnerships (PPPs) with the aim of diversifying and improving overall supply of water and wastewater services. One water supply source with a high importance for the water-scarce country of Jordan is seawater desalination. In this sense, the National Energy Strategy in Jordan provides investors with fiscal incentives, such as a 100% exemption from income tax over a period of 10 years, to encourage more IWPP projects [48]. IWPPs can also be involved in other supply services (e.g., wastewater treatment and reuse, bulk water markets, or water harvesting).

The newly built desalination plant near the city of Aqaba on the Red Sea is a case of an innovative business model of an IWPP. With a capacity of 500 m^3 per hour, the unit generates 5 MCM of freshwater per year. It runs under a 7-year build-operate-transfer (BOT) contract between the government-owned Aqaba Water Company and the private company KEMAPCO (Arab Fertilizers and Chemicals Industries). These water users buy produced water from the desalination plant, while the fertilizer company provides its outtake cooling water as intake for the plant and receives some brine produced by the plant as a fertilizer [71]. Some of the brine is also expected to be used for replenishing the Dead Sea water body which has been declining for years [72]. However, the practice and current impacts of brine disposal from projects in the Aqaba region are still controversial [73]. Another innovative part of this unit is that it is fully supplied by energy from renewable sources through methane gas and solar power, which generate enough energy to supply the entire project. The effect of this project will be threefold: it will provide water for people (social benefit), reduce the strain on water resources (ecological benefit), and improve water security (resilience). It is part of the first stage of the Red Sea-Dead Sea project, and is also one of the projects highlighted by the National Green Growth Plan (NGGP) as having a high cost–benefit ratio for investments [36]. In this context, desalination projects in the Aqaba regions are expected to augment water supply for cities, such as Amman, and foster private sector involvement as well as regional water cooperation between Jordan and Israel [74].

5.2.3. Business Model 3: Gesellschaft für Internationale Zusammenarbeit (GIZ)-Project "Increasing the Pumping Efficiency of the Water Authority of Jordan"

The water sector in Jordan consumes about 15% of the country's total electric power, most of which is attributed to water pumping [53]. The reason for this lies in the high variation in altitude of more than 1000 m across the country. In addition, Jordan strongly relies on groundwater abstraction, the well-fields for which are located at considerable distances from residential areas, and thus require a high amount of energy to extract, convey, and distribute water to the consumers. The cost of the energy bill in 2014 alone for the water sector was estimated to be 424.5 million USD [53]. These high energy costs in the water sector constitute a powerful incentive for the government to open

opportunities for businesses offering efficiency-enhancing technologies (e.g., increasing water pumping efficiency or using renewables).

As a response to the large amount of electricity needed for water pumping to supply the population in Jordan, an eco-efficient and sustainable model was introduced to reduce some of the immense costs and carbon emissions and implement an energy-efficient solution for water supply. The Gesellschaft für Internationale Zusammenarbeit (GIZ) promoted a business model that allowed the participation of the private sector in financing energy-efficient infrastructure for two pumping stations [75]. Private investments were encouraged for the operation of pumping stations for several years. The idea was to overcome key problems leading to low pump efficiency (e.g., lack of maintenance, fragmented responsibilities among different units of the public supply corporation, or inappropriate monitoring). The project brought together different consulting companies, donors, and suppliers for measuring efficiency and developing operation schemes with the private sector. This resulted in a decreased energy consumption of 3.6 GWh per year, which equals a reduction of 2500 tons of CO_2 per year. Furthermore, energy costs were cut by 313,000 USD per year [76]. Other positive side effects were the capacity-building and development of local staff. The project can be seen as a successful model for private sector participation in mitigating Greenhouse Gas (GHG) emissions and promoting a climate-friendly and resource-efficient economy, which is scheduled to be implemented in the remaining pumping stations in Jordan.

5.2.4. Business Model 4: EnvaTechs

The development and application of information technology (IT) in the water sector can have important potential to improve its performance on how to examine, design, manage, and optimize water and wastewater systems. According to the report "Water's Digital Future" by Global Water Intelligence [77], a large potential for water IT advanced applications is attributed to smart technologies, such as increased automation of processes in monitoring and controlling, wireless solutions, and sensors. Jordan has evolved as a regional tech start-up hub due to its ICT-(Information and Computer Technology)-focused educational system, low start-up costs, and a business-friendly environment. About 5700 ICT students, who can fill vacancies and further develop the industry, graduate each year [78]. The current national ICT strategy in Jordan aims to foster the growth of the IT sector by protecting intellectual property rights, increasing marketing efforts, and developing job skills of Jordanians to be employed in the sector [79].

Information technology is not only needed along the value chain of water, but also on the societal side to bring awareness about water usage and responsible resource consumption to a wide variety of people. "EnvaTechs" is an educational environmental start-up that aims to raise awareness about environmental challenges among the youth in Jordan, using technological applications such as virtual and augmented reality. The idea is to contribute to the youth's practical experiences in the environmental field through innovative learning methods, such as the development of environmental scenarios and IT-simulations of environmental impacts of projects and production. The services (e.g., trainings, simulations, and awareness campaigns) of this start-up are offered to schools, universities, companies, and governmental ministries. Some projects examples include storyboards using virtual reality applications of environmental scenarios such as water shortages or loss of biodiversity.

6. Discussion

Several industries within the Jordanian water sector have significant potential to embody green growth principles, and thus contribute to economic growth and sustainable development. The diagnostics tool thereby helps to identify green growth potential for industries and business models in the water sector, while the results will support the process of prioritizing upcoming efforts and investments by the government and the private sector. Policies that evolve out of these recommendations may determine the setting for the direction a government decides to take, and can therefore be seen as the framework that either supports or hinders the growth of industries and business models.

The green growth concept can be prioritized and implemented in the water sector through measures such as increasing the share of treated wastewater and its re-use up to 100%, or by a "renewable energy only" policy to meet the power demands in the water sector. Industries and businesses in the water sector will play a crucial role in being catalysts for green growth action. The diligent implementation of green growth principles may have several positive cross-industrial and cross-sectoral spillover effects. For example, the application of energy-efficient pumping technologies or biogas capture from WWTPs will have a spillover effect on the energy sector, while an increasing demand of water treatment technologies may have a spill-over effect on the consulting industry. The benefits will not be just contained within the organization applying the suitable measures, but will have impacts that go beyond their boundaries as the economy, environment, and governmental structures will profit from water- or cost-saving processes and technologies.

A number of constraints became apparent, which need to be addressed in order to ensure that green growth can be implemented in the water sector. Firstly, governmental bodies are still operating in a so-called "project-category mindset". There is a tendency to prefer prestigious mega-projects that rely on large quantities of money, which consequently means a large donor dependence. Furthermore, it is important to note that a project in itself, such as a wastewater treatment plant based on renewable energy, does not necessarily equate to green growth. It might fulfill green growth principles, but it needs to be seen primarily as an upgrade of the infrastructure. More importantly, such projects need, in a sustainable way, to be transferred to and reproduced in other sections of the economy. For example, the promotion of decentralized greywater treatment units could be a better model for companies than a central WWTP, because the diffusion of the technology would bring an increase in localized know-how and an independence from external structures.

A core strategy of green growth implementation would be to depart from a project-based approach to a more sustainable business-based approach. Here, the issue of scalability becomes vital. How can projects or models be transferred to support whole industries and sectors? The National Green Growth Plan includes ideas such as utilizing cross-sectoral interlinks and multipliers by clustering and subsidizing key initiatives, or through investments in capacity-building and knowledge. The suggested actions can help bring about the mutually reinforcing benefits deriving from a coordinated implementation of green growth interventions. However, major constraints still exist. These include a lack of financing mechanisms and sufficient funding capacity for green innovation. In fact, Jordan is still dependent on external support in order to realize some parts of its green growth ambitions. At the same time, Jordan needs to reform public funds to create the right incentives (e.g., investment returns) and awareness (e.g., through consultation in the development phase) among key stakeholders in the public and private sectors to stimulate a national and international engagement. Furthermore, detrimental water and energy subsidies in Jordan undermine the efforts to apply water-efficient technologies and renewable energy solutions. A reform in the pricing structure (especially in agriculture), however, has so far been difficult to enforce due to political resistance and lobbyism. Nonetheless, a changed tariff system is seen as being critical to creating incentives for people and companies to promote and apply resource-efficient green innovations.

7. Conclusions

Jordan serves as an interesting case study from the MENA region, as the national government is currently taking strategic decisions to pursue green growth and to implement the SDGs. We provide a diagnostics tool to assess green growth potentials in six industries within the Jordanian water sector. The tool helped to identify the correct prioritization of future investments and efforts of the public and private sectors. The prioritization of green growth measures helps apply the green growth paradigm in tangible areas of action. To illustrate those potentials, we provide four exemplary business models that reflect best practices in some of the industries. These examples reaffirm literature that stress the central role of innovations, both technological and organizational, in creating sustainable business models that correspond to the core criteria of green growth. They also illustrate how the complex nature of

green growth can be broken down to the reality of concrete industries and natural resources sectors. Green growth, which is seen in academic literature as an umbrella paradigm or a heuristic concept for sustainability, is practiced through sustainable businesses that show profitability and growth potentials. At the same time, these businesses need, by design, to exhibit environmental objectives such as resource efficiency, innovation, low-carbon production, reuse, or circular processing.

The results of concretizing green growth in the water sector of Jordan show that this sector can be a carrier of many of the premises of such growth. Often, green growth is conceptualized and measured from an economy-wide perspective. This can hinder the development of this idea on sector and industry levels through concrete examples of best practices and promising business models. The identified industries and businesses from Jordan emerged as a reaction to unsustainability pressures in the water sector in the context of aridity. These pressures arise from needs to find alternative resources, use the same resources more than once, increase use efficiency, and conservation as well as decrease the reliance on other sectors such as energy. The presented businesses have in common that they are enabled by technology and eco-innovations that were incorporated into their business plans. Further, they combine the use of renewables with elements from concepts such as decoupling, eco-innovations, circular production, or bio-economy. This corresponds to the notion of green growth, and, in fact, is indicative of the sustainability future of businesses in the area of natural resources. Furthermore, green growth businesses in Jordan reflect several comparative advantages in comparison to other countries in the region. Firstly, the water scarcity and the large differences in elevations across Jordan are key challenges, but can also be main drivers. Such challenges can fuel the further advancement of resource efficiency and eco-innovations (e.g., business focusing on energy efficiency in the water sector). Secondly, Jordan has a huge potential for renewable energy generation, especially in solar and wind energy, but also in biogas production, thus some business examples utilized this fact by deploying renewables or reusing self-produced energy. Third, wastewater treatment and re-use has already been implemented for a considerable time, and is based on a sound and supportive policy framework. Some identified businesses in this industry are capitalizing on the multiple benefits from wastewater treatment and reuse.

The experiences and lessons learned in Jordan may encourage other countries in the region to follow a similar path of a business-driven green growth for their economies. Although this study was focused on Jordan, the diagnostics tool is suitable to be applied to other countries as well, in order to identify green growth potentials in specific sectors. The sectors may vary from country to country, though water remains a crucial issue in the MENA region. Since some other states in the region (e.g., the United Arab Emirates and Morocco) are also working on green growth strategies, our assessment adds value to the current green growth discourse. There are common challenges facing a widespread and self-sustaining implementation of green growth in the region, such as the high energy and water subsidies, the dominance of inefficient public corporations, and the lack of funds and policies to encourage eco-innovations and entrepreneurship. Beyond our findings, some recommendations can be made based on insights gathered during this research. First, there is a need to facilitate a sustainable reproduction of scalable green innovations and business models that have spillover effects into neighboring sectors such as agriculture and energy, and thus to other sections of the economy. Second, it is recommended to prioritize investments in the suggested key industries by enhancing capacities for research and development (R&D), encouraging competition in the development of green growth ideas, and strengthening capabilities for the creation of an environment favorable for investments in the water sector.

Author Contributions: Conceptualization, J.E. and M.A.-S.; data curation, J.E.; formal analysis, J.E. and M.A.-S.; investigation, J.E. and M.A.-S.; methodology, J.E., M.A.-S. and J.H.; resources, J.E., M.A.-S. and J.H.; supervision, M.A.-S. and J.H.; validation, J.E. and M.A.-S.; visualization, J.E. and M.A.-S.; writing—original draft, J.E. and M.A.-S.; Writing—review and editing, J.E. and M.A.-S.

Acknowledgments: The publication of this article was funded by the Qatar National Library.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Kwon, H.K. A Complex Adaptive Systems Approach for the Green Growth. In Proceedings of the 54th Annual Meeting of the ISSS, Waterloo, ON, Canada, 18–23 July 2010.
2. Loiseau, E.; Saikku, L.; Antikainen, R.; Droste, N.; Hansjürgens, B.; Pitkänen, K.; Leskinen, P.; Kuikman, P.; Thomsen, M. Green economy and related concepts: An overview. *J. Clean. Prod.* **2016**, *139*, 361–371. [CrossRef]
3. Organisation for Economic Co-operation and Development (OECD). *Tools for Delivering on Green Growth*; OECD: Paris, France, 2011.
4. Organisation for Economic Co-operation and Development (OECD). *Towards Green Growth?: Tracking Progress*; OECD: Paris, France, 2015.
5. Vazquez-Brust, D.A.; Sarkis, J. *Green Growth: Managing the Transition to a Sustainable Economy*; Springer: Dordrecht, The Netherlands, 2012.
6. Beltramello, A.; Haie-Fayle, L.; Pilat, D. *Why New Business Models Matter for Green Growth*; Organisation for Economic Co-operation and Development (OECD): Paris, France, 2013.
7. Bocken, N.; Ritala, P.; Albareda, L.; Verburg, R. (Eds.) *Innovation for Sustainability: Business Transformations Towards a Better World*; Palgrave Macmillan: London, UK, 2019.
8. Rizos, V.; Behrens, A.; van der Gaast, W.; Hofman, E.; Ioannou, A.; Kafyeke, T.; Flamos, A.; Rinaldi, R.; Papadelis, S.; Hirschnitz-Garbers, M.; et al. Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. *Sustainability* **2016**, *8*, 1212. [CrossRef]
9. Onyido, T.B.C.; Boyd, D.; Thurairajah, N. Developing SMEs as environmental businesses. *Constr. Innov.* **2016**, *16*, 30–45. [CrossRef]
10. Machiba, T. Eco-innovation for enabling resource efficiency and green growth: development of an analytical framework and preliminary analysis of industry and policy practices. *Int. Econ. Econ. Policy* **2010**, *7*, 357–370. [CrossRef]
11. Hammer, S.; Kamal-Chaoui, L.; Robert, A.; Plouin, M. *Cities and Green Growth: A Conceptual Framework*; Organisation for Economic Co-operation and Development (OECD): Paris, France, 2011.
12. Kim, S.E.; Kim, H.; Chae, Y. A new approach to measuring green growth: Application to the OECD and Korea. *Futures* **2014**, *63*, 37–48. [CrossRef]
13. Sonnenschein, J.; Mundaca, L. Decarbonization under green growth strategies? The case of South Korea. *J. Clean. Prod.* **2016**, *123*, 180–193. [CrossRef]
14. Lyytimäki, J.; Antikainen, R.; Hokkanen, J.; Koskela, S.; Kurppa, S.; Känkänen, R.; Seppälä, J. Developing Key Indicators of Green Growth. *Sustain. Dev.* **2018**, *26*, 51–64. [CrossRef]
15. Stoknes, P.E.; Rockström, J. Redefining green growth within planetary boundaries. *Energy Res. Social Sci.* **2018**, *44*, 41–49. [CrossRef]
16. Mundaca, L.; Luth Richter, J. Assessing 'green energy economy' stimulus packages: Evidence from the U.S. programs targeting renewable energy. *Renew. Sustain. Energy Rev.* **2015**, *42*, 1174–1186. [CrossRef]
17. Georgeson, L.; Maslin, M.; Poessinouw, M. The global green economy: A review of concepts, definitions, measurement methodologies and their interactions. *Geo: Geogr. Environ.* **2017**, *4*, e00036. [CrossRef]
18. Pearce, D.W.; Barbier, E.; Markandya, A. *Blueprint for a Green Economy*; Earthscan: London, UK, 1989.
19. Jacobs, M. Green growth: Economic theory and political discourse. In *The Handbook of Global Climate and Environment Policy*; Falkner, R., Ed.; Wiley-Blackwell: Hoboken, NJ, USA, 2013; pp. 197–214.
20. Sterner, T.; Damon, M. Green growth in the post-Copenhagen climate. *Energy Policy* **2011**, *39*, 7165–7173. [CrossRef]
21. Barbier, E.B. The Green Economy Post Rio+20. *Science* **2012**, *338*, 887–888. [CrossRef] [PubMed]
22. Hall, C.M. Framing behavioural approaches to understanding and governing sustainable tourism consumption: beyond neoliberalism, "nudging" and "green growth"? *J. Sustain. Tour.* **2013**, *21*, 1091–1109. [CrossRef]
23. Wanner, T. The New 'Passive Revolution' of the Green Economy and Growth Discourse: Maintaining the 'Sustainable Development' of Neoliberal Capitalism. *New Political Econ.* **2015**, *20*, 21–41. [CrossRef]
24. Gough, I. Can Growth Be Green? *Int. J. Health Serv.* **2015**, *45*, 443–452. [CrossRef] [PubMed]
25. Brown, E.; Cloke, J.; Gent, D.; Johnson, P.H.; Hill, C. Green growth or ecological commodification: Debating the green economy in the global south. *Geogr. Ann. Ser. B Hum. Geogr.* **2014**, *96*, 245–259. [CrossRef]

26. Dercon, S. Is Green Growth Good for the Poor? The World Bank: Washington, DC, USA, 2014.
27. Jakob, M.; Edenhofer, O. Green growth, degrowth, and the commons. *Oxf. Rev. Econ. Policy* **2014**, *30*, 447–468. [CrossRef]
28. Barbier, E.B. Is green growth relevant for poor economies? *Resour. Energy Econ.* **2016**, *45*, 178–191. [CrossRef]
29. Resnick, D.; Tarp, F.; Thurlow, J. The political economy of green growth: Cases from Southern Africa. *Public Admin. Dev.* **2012**, *32*, 215–228. [CrossRef]
30. Mathews, J.A. Green growth strategies—Korean initiatives. *Futures* **2012**, *44*, 761–769. [CrossRef]
31. Kunapatarawong, R.; Martínez-Ros, E. Towards green growth: How does green innovation affect employment? *Res. Policy* **2016**, *45*, 1218–1232. [CrossRef]
32. Martínez-Ros, E. Kunapatarawong, R. Green Innovation and knowledge: The role of size. *Bus. Strategy Environ.* **2019**. published online. [CrossRef]
33. Engelmann, J.; Al-Saidi, M. Business-Driven Ecological Innovations in Green Growth Strategies. In *Innovation for Sustainability: Business Transformations Towards a Better World*; Bocken, N., Ritala, P., Albareda, L., Verburg, R., Eds.; Palgrave Macmillan: London, UK, 2019; pp. 97–113.
34. Jänicke, M. "Green growth": From a growing eco-industry to economic sustainability. *Energy Policy* **2012**, *48*, 13–21. [CrossRef]
35. Antal, M.; van den Bergh, J.C.J.M. Green growth and climate change: Conceptual and empirical considerations. *Clim. Policy* **2016**, *16*, 165–177. [CrossRef]
36. Ministry of Environment (MoEnv). *A National Green Growth Plan for Jordan, Ministry of Environment*; MoEnv: Amman, Jordan, 2017.
37. Khoday, K.; Perch, L.; Scott, T. Green economy pathways in the Arab Gulf: Global perspectives and opportunities. In *The Green Economy in the Gulf*; Raouf, M.A., Luomi, M., Eds.; Routledge: Abingdon, UK, 2016; pp. 238–257.
38. United Nations Economic Commission for Africa. *Industry and the Green Economy in North Africa: Challenges, Practices and Lessons Learned*; United Nations Economic Commission for Africa: Addis Ababa, Ethiopia, 2015.
39. Organisation for Economic Co-operation and Development (OECD). *Eco-Innovation in Industry [Electronic Resource]: Enabling Green Growth*; OECD: Paris, France, 2009.
40. AtKisson, A. *Life beyond Growth*; Annual survey report; Institute for Studies in Happiness, Economy, and Society: Tokyo, Japan, 2012.
41. Organisation for Economic Co-operation and Development (OECD). *Green Growth and Developing Countries: A Summary for Policy Makers*; OECD: Paris, France, 2012.
42. Fay, M. *Inclusive Green Growth: The Pathway to Sustainable Development*; World Bank: Washington, DC, USA, 2012.
43. United Nations Environmental Programme (UNEP); International Resource Panel (IRP). *Options for Decoupling Economic Growth from Water Use and Pollution: A Report of the Water Working Group of the International Resource Panel*; UNEP: Nairobi, Kenya, 2015.
44. United Nations Framework Convention on Climate Change (UNFCCC). *Adoption of the Paris Agreement*; UNFCCC: Bonn, Germany, 2015.
45. Krämer, A.; Herrendorf, M. *Policy Measures to Support Inclusive and Green Business Models*; United Nations Global Compact: New York, NY, USA, 2012.
46. Borel-Saladin, J.M.; Turok, I.N. The Green Economy: Incremental Change or Transformation? *Environ. Policy Gov.* **2013**, *23*, 209–220. [CrossRef]
47. D'Amato, D.; Droste, N.; Allen, B.; Kettunen, M.; Lähtinen, K.; Korhonen, J.; Leskinen, P.; Matthies, B.D.; Toppinen, A. Green, circular, bio economy: A comparative analysis of sustainability avenues. *J. Clean. Prod.* **2017**, *168*, 716–734. [CrossRef]
48. Ministry of Water and Irrigation (MWI). *National Water Strategy 2016–2025*; MWI: Amman, Jordan, 2016.
49. Ministry of Water and Irrigation (MWI). *Water Sector Capital Investment Plan 2016–2025*; MWI: Amman, Jordan, 2016.
50. Al Qatarneh, G.N.; Al Smadi, B.; Al-Zboon, K.; Shatanawi, K.M. Impact of climate change on water resources in Jordan: A case study of Azraq basin. *Appl. Water Sci.* **2018**, *8*, 50. [CrossRef]
51. Al-Bakri, J.; Suleiman, A.; Abdulla, F.; Ayad, J. Potential impact of climate change on rainfed agriculture of a semi-arid basin in Jordan. *Phys. Chem. Earth Parts A/B/C* **2011**, *36*, 125–134. [CrossRef]

52. Hamdi, M.R.; Abu-Allaban, M.; Elshaieb, A.; Jaber, M.; Momani, N.M. Climate change in Jordan: A comprehensive examination approach. *Am. J. Environ. Sci.* **2009**, *5*, 740–750. [CrossRef]
53. Ministry of Water and Irrigation (MWI). *Energy Efficiency and Renewable Energy Policy*; Ministry of Water and Irrigation: Amman, Jordan, 2016.
54. Ministry of Water and Irrigation (MWI). *Water Reallocation Policy*; MWI: Amman, Jordan, 2016.
55. Al-Saidi, M.; Dehnavi, S. Comparative Scorecard Assessment of Urban Water Pricing Policies—The Case of Jordan and Iran. *Water* **2019**, *11*, 704. [CrossRef]
56. Hussein, H. Tomatoes, tribes, bananas, and businessmen: An analysis of the shadow state and of the politics of water in Jordan. *Environ. Sci. Policy* **2018**, *84*, 170–176. [CrossRef]
57. Yorke, V. Jordan's Shadow State and Water Management: Prospects for Water Security Will Depend on Politics and Regional Cooperation. In *Society, Water, Technology: A Critical Appraisal of Major Water Engineering Projects*; Huettl, R.F., Bens, O., Bismuth, C., Hoechstetter, S., Eds.; Springer: Cham, Switzerland, 2015; pp. 227–251.
58. Salamah, E.; Shteiwi, M.; Raggad, M. *Water Resources of Jordan: Political, Social and Economic Implications of Scarce Water Resources*; Salameh, E., Shteiwi, M., Al Raggad, M., Eds.; Springer: Cham, Switzerland, 2018.
59. Hussein, H. Lifting the veil: Unpacking the discourse of water scarcity in Jordan. *Environ. Sci. Policy* **2018**, *89*, 385–392. [CrossRef]
60. Ministry of Environment (MoEnv). *Towards a Green Economy in Jordan: A Scoping Study*; MoEnv: Amman, Jordan, 2011.
61. Hausmann, R.; Rodrik, D.; Velasco, A. Growth Diagnostics. In *The Washington Consensus Reconsidered: Towards a New Global Governance*; Serra, N., Stiglitz, J.E., Eds.; Oxford University Press: Oxford, UK, 2008; pp. 324–355.
62. Pueyo, A. What constrains renewable energy investment in Sub-Saharan Africa? A comparison of Kenya and Ghana. *World Dev.* **2018**, *109*, 85–100. [CrossRef]
63. Dual Citizen LLC. The Global Green Economy Index: Measuring National Performance in the Green Economy. 2016. Available online: https://dualcitizeninc.com/GGEI-2016.pdf (accessed on 9 May 2019).
64. Sander, H. *What Can Be Learned from "Green Growth Diagnostics" for Greening the Growth Path of China?—Conceptional Issues and Industry Evidence*; Maastricht School of Management: Maastricht, The Netherlands, 2011.
65. Government of the Republic of Korea; Presidential Committee on Green Growth; Korea Water Resources Corporation; World Water Council. 2012. Available online: http://www.worldwatercouncil.org/sites/default/files/Thematics/Water_and_Green_Growth_vol_1.pdf (accessed on 1 May 2019).
66. Ministry of Planning and International Cooperation (MoPIC). *Executive Development Program 2011–2013*; MoPIC: Amman, Jordan, 2010.
67. Halalsheh, M.; Kassab, G. Policy and the Governance Framework for Wastewater Irrigation: Jordanian Experience. In *Safe Use of Wastewater in Agriculture: From Concept to Implementation*; Hettiarachchi, H., Ardakanian, R., Eds.; Springer: Cham, Switzerland, 2018; pp. 75–99.
68. Gebrezgabher, S.; Rao, K.; Hanjra, M.A.; Hernández-Sancho, F. Business Models and Economic Approaches for Recovering Energy from Wastewater and Fecal Sludge. In *Wastewater: Economic Asset in an Urbanizing World*; Drechsel, P., Qadir, M., Wichelns, D., Eds.; Springer: Dordrecht, The Netherlands, 2015; pp. 217–245.
69. Suez Environment. As Samra Wastewater Treatment Plant, A major Asset for Jordan. 2016. Available online: https://www.suezwaterhandbook.com/case-studies/wastewater-treatment/As-Samra-wastewater-treatment-plant-Jordan (accessed on 12 December 2018).
70. Salahat, M.A.; Al-Qinna, M.I.; Badran, R.A. Potential of Treated Wastewater Usage for Adaptation to Climate Change: Jordan as a Success Story: Water Resources in Arid Areas: The Way Forward. In *Water Resources in Arid Areas: The Way Forward*; Abdalla, O., Kacimov, A., Chen, M., Al-Maktoumi, A., Al-Hosni, T., Clark, I., Eds.; Springer: Cham, Switzerland, 2017.
71. Water. Desalination + Reuse. Jordan's First SWRO Opens for Business. 2017. Available online: https://www.desalination.biz/news/3/Jordans-first-SWRO-opens-for-business/8760/ (accessed on 2 May 2019).
72. Hosking, J. Red Sea-Dead Sea Project: Too Little, Too Late? Available online: http://www.venturemagazine.me/2015/06/red-sea-dead-sea-project-too-little-too-late/ (accessed on 9 May 2019).
73. Lykkebo Petersen, K.; Paytan, A.; Rahav, E.; Levy, O.; Silverman, J.; Barzel, O.; Potts, D.; Bar-Zeev, E. Impact of brine and antiscalants on reef-building corals in the Gulf of Aqaba—Potential effects from desalination plants. *Water Res.* **2018**, *144*, 183–191. [CrossRef] [PubMed]

74. Rabadi, A. The Red Sea–Dead Sea desalination project at Aqaba. *Desalin. Water Treat.* **2016**, *57*, 22713–22717. [CrossRef]
75. Gesellschaft für Internationale Zusammenarbeit (GIZ). *Improving Energy Efficiency in the Water Sector. Project Data*; GIZ: Eschborn, Germany, 2019.
76. Gesellschaft für Internationale Zusammenarbeit (GIZ). *Coping with Water Scarcity under Changing Climate Conditions: Best Practices and Innovations on Trial*; GIZ: Eschborn, Germany, 2016.
77. Global Water Intelligence (GWI). *Water's Digital Future: The Outlook for Monitoring, Control and Data Management Systems*; GWI: Oxford, UK, 2016.
78. U.S. Department of Commerce's International Trade Administration. Jordan Country Commercial Guide, Information and Communication Technology. 2017. Available online: https://www.export.gov/article?id=Jordan-Information-and-Communication-Technology (accessed on 12 December 2018).
79. Ministry of Information and Communications Technology (MoICT). *Jordan National Information and Communications Technology Strategy*; MoICT: Amman, Jordan, 2013.