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A Multi-dimension Sustainability Assessment of the Economic Growth in Jordan Using the Sustainability Window Analysis

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Abstract

This study aims to holistically appraise the economic growth in Jordan over the 2006–2016 period, and to highlight the corrective measures to transition the Jordanian economy to a greener pathway. The Sustainability Window (SuWi) analysis tool was utilized under four scenarios: In scenario 1, gross domestic product (GDP) and greenhouse gas (GHG) per capita were the economic and environmental indicators; and employment, healthy life, and education were the social indicators. Scenarios 2 and 3 were similar to scenario 1 except that the environmental indicator was GHG intensity in scenario 2 and consumption in scenario 3. In scenario 4, GDP per capita was the economic indicator, employment was the social indicator, and GHG per capita, GHG intensity, and consumption were the environmental indicators. The economic growth over the study period satisfied all sustainability criteria except when the education was used as the social indicator. The economic growth was coupled with a decline in GHG intensity, GHG per capita, and consumption values and a rise in employment and healthy life values. The normalized economic indicator value in the final year was 2.568 for scenarios 1, 2, and 3 and 1.610 for scenario 4. Despite the slight growth of employment over the study period, a sharp drop has been witnessed lately which is anticipated to worsen in the coming years. To successfully place the Jordanian economy on a greener pathway, it is key to promote new industries and emerging businesses, stimulate private sector investments, and adopt transparent governance processes and enforcement mechanisms.

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Introduction

The international efforts toward environmental protection and climate change mitigation in recent decades have been crowned by monumental agreements and conventions such as the Paris Agreement in 2015 and the Kyoto Protocol in 1997, which were centered around lowering the greenhouse gas (GHG) emissions through nationally determined contributions, with a greater responsibility placed on developed countries due to their historical role in the global GHG emissions (Abu Hajar et al., 2020; Henderson, 2007; Luukkanen et al., 2019). Subsequently, many countries have integrated the principles of sustainable development (SD) and green growth (GG) into their economic growth agendas and developed action plans to facilitate the transition into sustainable and green pathways in multiple sectors (Yang & Huang, 2019).

Jordan is an upper middle income country in the Middle East which shares borders with Syria, Iraq, Saudi Arabia, and Palestine. The total population in Jordan has increased from 3.57 million in 1990 to nearly 10 million in 2018 over a surface area of 89,300 km^2, and the corresponding 2018 population density was 112 per km^2. Life expectancy in Jordan has increased from 66 years in 1980 to 74.4 years in 2014. The rapid population growth is in part driven by the forced migrations from neighboring countries. The gross national income (GNI) per capita in 1990 was $1,270, and the Jordanian economy was growing slowly during the 1990s because of the fluctuating oil prices after the first Gulf War (1990–1991). However, the country has seen considerable growth in the new millennium despite the continuous rise in oil prices and the regional instability, and the GNI per capita increased to $4,200 in 2018 (MoEnv, 2017; The World Bank Group, 2020a).

Jordan has recently ratified the Paris Agreement with an unconditional nationally determined contribution (NDC) of 1.5% of the country's net GHG emissions which can reach 14% subject to foreign support. Consequently, the Government of Jordan (GoJ) has launched a GG agenda in 2017 to steadily transition the Jordanian economy into a greener track which achieves economic growth and prosperity while taking into account the environmental and social sustainability aspects (MoEnv, 2017).

In view of the Jordanian endeavors to embrace a GG trajectory in many economic sectors, this study examined the economic growth in Jordan over the 2006–2016 period from a sustainability perspective to ascertain whether the prevailing growth scheme is gradually shifting toward a more inclusive and resilient GG pathway and to pinpoint the gaps and discuss the potential corrective actions. Several strong and weak social, environmental, and economic indicators were explored using the interdisciplinary Sustainability Window tool to simultaneously assess the attainment of the three sustainability dimensions. The selected indicators are directly linked to the priority sectors identified by the GoJ, and the

suitability of those indicators was assessed based on the study period data. To the authors' best knowledge, this is the first study to holistically appraise the economic growth in Jordan from all sustainability dimensions, and to highlight the gaps and potential corrective measures. Furthermore, this study lays out a simple framework for sustainability assessment which can be applied at a smaller scale to underline the sustainability gaps in specific sectors.

Literature Review

The GG and SD notions have come to light globally as means to rectify the flaws in the prevailing economic development and mitigate the adverse consequences on the environment, society, and ecosystems. GG is defined as a low-carbon development aiming to grow the economy and create green jobs without compromising the well-being of the environment and society (Kumar, 2017; MoEnv, 2017; Sulich et al., 2020). SD, on the other hand, is an interdisciplinary development approach seeking to serve the current needs without compromising the ability of the future generations to meet their own needs by simultaneously fulfilling the economic prosperity, environmental well-being, and social equity goals (de Vries & Petersen, 2009; Sauvé et al., 2016). The SD concept was acknowledged as a global development track in the Earth Summit, Rio de Janeiro 1992, when most nations signed the United Nations Framework Convention on Climate Change (UNFCCC) with the goal to combat climate change and mitigate other adverse environmental consequences (Barbier, 2011). Two decades later, the GG term was embraced in the United Nations Conference on Sustainable Development (UNCSD) which took place in Rio de Janeiro in 2012, where the convened parties unanimously agreed that it was time to transform the global development to a greener pathway to put an end to the environmental and ecological deterioration (Abu Hajar, et al., 2020; Barbier, 2011; Bina, 2013; Wanner, 2015). Concerns were raised that embracing GG may tacitly undermine the SD principles, in essence due to the 20-year span between the two terminologies besides the fact that SD is viewed by many as a passive and vague approach to limit growth. However, GG was brought to life to reinvigorate the SD concepts, advocate its principles within the market context, and decouple the economic growth and environmental degradation (Bartelmus, 2013; Bek et al., 2017; Drimili et al., 2019; Xue, 2012).

The political status in the Middle East directly influences Jordan's socioeconomic status due to the excessive dependence on imported oil. The Jordanian economy is highly vulnerable to oil price shocks which are frequently triggered by political factors. Therefore, the economic growth in Jordan is substantially different from an inclusive, resilient, and GG. Furthermore, development in Jordan is highly unbalanced between urban and rural regions; and the unemployment rates are steadily increasing (Abu Hajar et al., 2020; MoEnv, 2017). As a result, a resilient and inclusive green economy is desired to address the shortcomings of the prevailing growth scheme in Jordan. The GG agenda has designated six priority sectors with high GG potential, namely energy, transport, water, agriculture, tourism, and waste (GoJ, 2015; MoEnv, 2017). Nevertheless, there are several barriers which may obstruct the GG agenda in Jordan such as the heavy dependence on external funding, the

rich history of plans and strategies in Jordan without proper implementation, and the substantial dependence on nonrenewable fossil fuels (MoEnv, 2017).

The key economic sectors with the highest contribution to the gross domestic product (GDP) in Jordan are the governmental services, finance, manufacturing, transport, tourism, and hospitality (The Economic Policy Council, 2018). Regardless of the economic growth, unemployment is escalating in Jordan, and it has been reported that unemployment rate was 19.1% at the end of 2019 with relatively low female participation in the labor market. The absolute poverty rate in Jordan was 14.4% in 2010 which increased to 15.7% in 2018, and these figures only accounted for Jordanians, while a good percentage of non-citizens residing on Jordanian soil (e.g., migrant workers and refugees) live below the Jordanian poverty line. Education in Jordan is deemed among the best in the region with relatively high enrolment rates. The average number of students per class unit is 25.1 while the average number of students per teacher is 15.4. Jordan also has an advanced healthcare system providing citizens with healthcare services at a relatively low cost and 73% of Jordanians are covered with health insurance (UNICEF, 2020). Water scarcity is among the key challenges facing Jordan and the per capita share of water is around 125 m^3 per year, which is one of the lowest in the world. The freshwater resources in Jordan are decreasing at a distressing rate due to the recurring droughts over recent years, the overexploitation of nonrenewable groundwater resources, and the nonrevenue water which accounts for 48% of water supply in Jordan (Abu Hajar, 2018; Abu Hajar et al., 2019; MoEnv, 2017; UNICEF, 2020).

To assess GG and SD progress, it is essential to develop and utilize robust assessment tools which incorporate one or more sustainability dimensions and reduce a set of sustainability indicators to manageable and meaningful guidelines for decision-making. Although one-dimensional tools have been used for sustainability assessment, multi-dimensional tools which are aligned with the sustainable development goals (SDGs) are more prudent. Another crucial issue in sustainability assessment is the selection of proper indicators to accurately reflect each sustainability dimension, and the literature is in fact abundant with indicators which can be used to effectively assess the economic, environmental, and social dimensions (Luukkanen et al., 2019; Yang & Huang, 2019). One of the novel sustainability assessment tools is the Sustainability Window (SuWi) tool which is a robust interdisciplinary framework for assisting policy and decision-makers to achieve the desired balance between the sustainability dimensions and make informed decisions for existing and future alternatives. The success of the SuWi analysis depends primarily on the selection of compatible indicators. A multitude of strong and weak indicators are reported in the literature to reflect the different sustainability dimensions. Strong indicators are more stringent and often lead to more conservative conclusions compared to weak indicators. For example, the net GHG emissions is a stronger environmental indicator compared to the GHG emissions intensity (per unit GDP), and the number of jobs created per unit GDP is a stronger social indicator compared to the total number of jobs created (Abu Hajar et al., 2020; Luukkanen et al., 2019).

The most commonly used economic indicator is the GDP, which measures the market value of all goods and services in a country. GDP is a widely used measure for the growth and well-being of economies, and is often expressed as absolute

GDP or GDP per capita (SSF, 2017). The GDP correlates well with the sustainability dimensions, particularly the environmental dimension, and the rationale behind this association is that an economic growth is typically realized on the expense of natural resources consumption (e.g., loss of forests cover) (Santiago & do Couto, 2020). The environmental dimension can be represented by a wide array of indicators which measure different aspects of the environment and ecosystems such as biodiversity protected areas, renewable water resources, ecological footprint, energy use and efficiency, GHG emissions, and the renewable energy share. The social dimension can also be gauged by indicators which assess the progress in the human development and society well-being such as safe sanitation, education, healthy life, population growth, and employment rate (Luukkanen et al., 2019; SSF, 2017; Zhang et al., 2009).

Data and Methods

The SuWi tool was utilized to assess the economic growth in Jordan by simultaneously taking into account the economic, social, and environmental dimensions. The SuWi tool is built on the concept of simultaneous integration of different sustainability dimensions by identifying a window of economic growth where the limits of this window are the minimum economic growth which will sustain the social well-being and the maximum economic growth which will satisfy the environmental sustainability. Additionally, the SuWi tool detects the undesirable consequences of economic growth such as a jobless growth or an economic growth which causes damage to the environment and ecosystems (Luukkanen et al., 2019).

Proper indicators are selected to reflect the economic, environmental, and social dimensions, and all indicators are indexed to have a value of 1.0 for the base year and the indicator values in subsequent years are normalized with respect to the base year values (i.e., $\text{value}_t/\text{value}_0$). The SuWi analysis is best represented graphically where the economic growth is portrayed on the x-axis while the social and environmental progress are displayed on the y-axis (Luukkanen et al., 2019). Figure 1 is an illustrative example of SuWi analysis using GDP as the economic indicator, safe sanitation as the social indicator, and GHG intensity as the environmental indicator. The blue and green series represent the social and environmental progress, respectively, which correspond to the economic growth over the study period. Line 1 (black dashed line) depicts the economic growth trajectory should the growth endure the rate defined by the origin (0,0) and the base year (1,1). Line 2 (blue dashed line) defines the desired economic growth course such that the social dimension is not adversely affected; that is, the normalized social indicator value at the final year remains 1.0. Similarly, line 3 (green dashed line) defines the desired economic growth course that will not negatively affect the environmental dimension (the normalized environmental indicator at the final year remains 1.0). A horizontal line extending from the base year coordinates and crossing lines 2 and 3 defines the SuWi limits; the intersection with line 2 is the minimum economic growth to maintain the social well-being while the intersection with line 3 is the maximum economic growth to attain

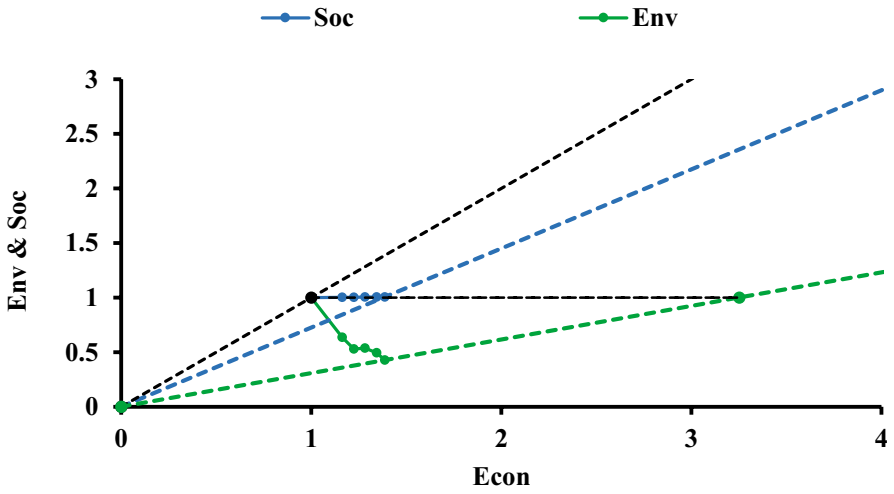

Fig. 1 SuWi analysis example using GPD as the economic indicator, safe sanitation as the social indicator, and GHG intensity as the environmental indicator

the environmental sustainability. The economic growth over the study period can be assessed by inspecting the blue and green series and verifying whether the observed economic growth is within the SuWi limits. Alternatively, the SuWi limits can be defined as follows (Luukkanen et al., 2019):

$$SW_{min} = \frac{Econ_t/Econ_o}{Soc_t/Soc_0} \tag{1}$$

$$SW_{max} = \frac{Econ_t/Econ_o}{Env_t/Env_0} \tag{2}$$

where SW_{min} and SW_{max} are the lower and upper limits of a sustainable economic growth in year t, respectively; $Econ_0$ and $Econ_t$ are the economic indicator values for the base and final years; Soc_0 and Soc_t are the social indicator values for the base and final years; and Env_0 and Env_t are the environmental indicator values for the base and final years (Abu Hajar et al., 2020; Luukkanen et al., 2019).

In this study, a broad set of social, environmental, and economic indicators was reviewed and different combinations of indicators were examined to assess their compatibility for SuWi analysis. If for a certain combination of indicators the SuWi limits are reversed (SW_{max} is less than SW_{min}), then one or more of the indicators are not compatible with the others. It was inferred that the net GHG emissions (in million tonnes CO_2 equivalent) indicator is not compatible with the economic indicators GDP and GDP per capita regardless of the social indicator used. On the contrary, the environmental indicators GHG intensity, GHG per capita, and consumption (in global hectares per person) are compatible with the GDP and GDP per capita. Therefore, GDP and GDP per capita were used as economic indicators; GHG

intensity, GHG per capita, and consumption were used as environmental indicators; and healthy life, employment, and education were used as social indicators. The consumption indicator (in global hectares per person) is a measure of the ecological footprint minus the carbon footprint. The education indicator measures the gross enrolment in primary, secondary, and tertiary education with respect to the school-age population. The healthy life is an indicator on a country's healthcare by measuring the number of years a newborn is expected to live minus years spent in poor health. The employment indicator measures the proportion of employed people in the total labor force (SSF, 2017).

The 2006–2016 was selected as a study period due to data availability. The economic growth during the first half of this period was rapid; however, a slower growth was experienced in the second half due to sociopolitical causes. The population and GDP data were obtained from the World Bank Open Data (The World Bank Group, 2019a). The net annual GHG emissions were obtained from Jordan's Third National Communication on Climate Change (MoEnv, 2014). Other social and environmental data (consumption, healthy life, employment, and education) were obtained from SSF (2017) and were also validated from other references in Jordan such as annual reports on education, labor, social development, etc. A summary of the raw data used for SuWi analysis in this study is presented in Table 1.

Results and Discussion

There are several flaws and vulnerabilities in the classic economic growth in Jordan from a GG perspective including the fossil fuel fixation, overexploitation of groundwater, overlooking the environmental sustainability in many sectors, unbalanced growth between urban and rural regions, the undue reliance on foreign financial support and expatriate Jordanians remittances, and the continuous migration and loss of talented and skillful labor force (Al-Smadi et al., 2019; MoEnv, 2017). The economic growth in Jordan over the 2006–2016 period was assessed using the SuWi tool to pinpoint the gaps and highlight the potential affirmative actions toward an inclusive green and sustainable growth.

The first SuWi trial (scenario 1) was conducted using GDP as the economic indicator, GHG per capita as the environmental indicator, and three social indicators: education, healthy life, and employment as shown in Fig. 2. Although GHG per capita is a relatively weak environmental indicator in comparison to the net GHG emissions, the latter has been found incompatible with the SuWi analysis when the GDP or GDP per capita were used as economic indicators. It can be observed from Fig. 2 that the green series is well below the upper SuWi limit which denotes that the economic growth satisfied the environmental sustainability criterion over the study period. The net GHG emissions in Jordan have been increasing steadily over the study period from 28.7 million tonnes CO_2 equivalent (tCO_2-eq) in 2006 to nearly 31.5 million tCO_2-eq in 2016, and it is anticipated that the net GHG emissions will continue to rise by 2% annually should the existing economic growth scheme persist. Nearly 84% of the GHG emissions in Jordan are carbon dioxide, 11% methane, and 5% nitrous oxide,

Table 1 Summary of the social, environmental, and economic raw data used for SuWi analysis

Indicator/parameter	Employment	Population	Education	Healthy life	Consumption	GHG emissions	GDP
Unit	%	–	Enrolment rate %	Years	Global hectares per person	Million tonnes CO_2 equivalent	Billion US dollar
2006	87.6	5,991,540	82.4	63.5	1.211	28.717	15.268
2008	86.0	6,556,478	81.7	64.0	1.106	26.685	22.280
2010	87.3	7,261,539	81.9	64.3	1.043	26.677	26.796
2012	87.5	8,090,872	76.8	64.6	0.903	31.704	31.371
2014	87.8	8,920,049	76.4	64.8	0.968	33.832	36.329
2016	88.9	9,551,467	76.4	65.0	1.004	31.456	39.197

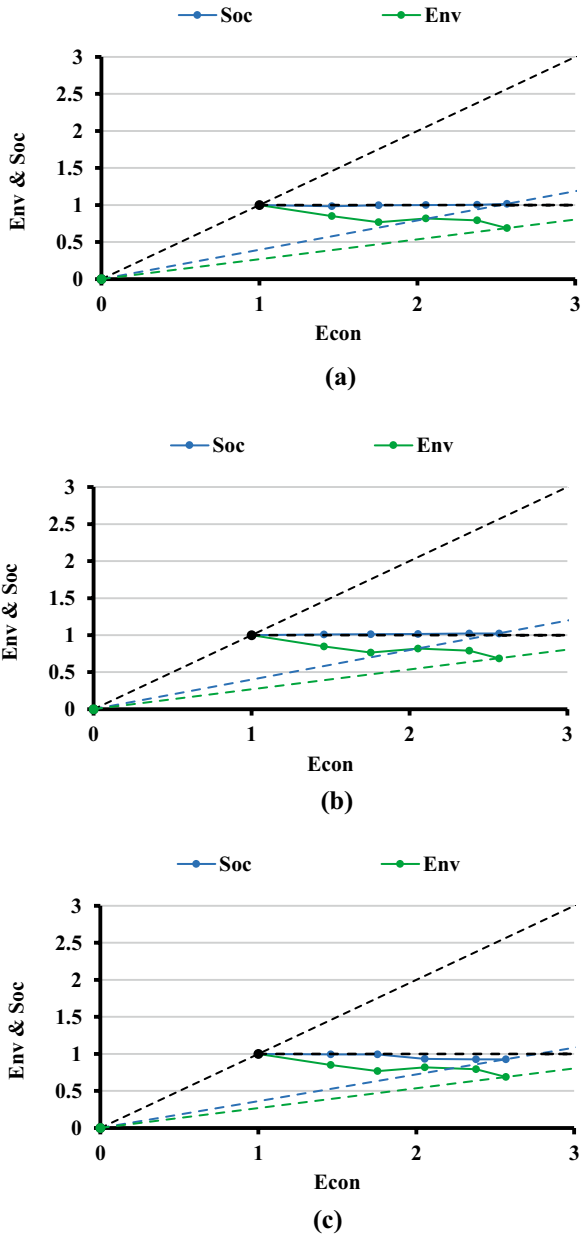

Fig. 2 SuWi analysis (scenario 1) when GDP is the economic indicator, GHG per capita is the environmental indicator, and **a** employment is the social indicator, **b** healthy life is the social indicator, and **c** education is the social indicator

while the fluorinated gas emissions are negligible. 77% of the net GHG emissions in Jordan are attributed to energy consumed in the energy industries (electricity and heat production, petroleum refining, production of other fuels), transport, and other sectors (MoEnv, 2014). Nonetheless, GHG per capita has decreased from

4.79 tCO_2-eq in 2006 to 3.29 tCO_2-eq in 2016. As a result, the economic growth was deemed environmentally sustainable using the GHG per capita indicator.

The GoJ has taken several serious steps toward environmental protection and sustainability. Several initiatives and green funds have been launched to support renewable energy, green housing, water conservation, waste recycling, ecotourism, and clean transportation projects. Moreover, the GoJ has ratified the Paris Agreement and subsequently launched a national GG plan in 2017 to complement the existing governmental policies and strategies and accelerate the transition into an inclusive green economy. The GG plan capitalizes on the unique opportunities to green the Jordanian economy at a relatively low cost by prioritizing projects in the energy, transport, water, agriculture, waste, and tourism sectors. For instance, renewable energy projects are attractive in Jordan due to the high irradiance levels (4–7 kWh per m^2) with more than 330 sunny days per year. Consequently, a rapid increase in solar and wind farms has been witnessed over the past decade, and the current renewables contribution is approximately 10% of the overall energy mix. Renewable energy not only leads to lower GHG emissions, but also lessens the energy financial burdens considerably. Fossil fuel expenses in Jordan are estimated at 18% of the GDP; thus, increasing the share of renewables is desirable to meet the intended NDC and increase the economy's resilience against fluctuations in oil prices. Regardless, fossil fuels will remain as the major source of energy in Jordan in the foreseeable future (Abu Hajar et al., 2020, 2021; MoEnv, 2017). The transport sector is the second largest contributor to GHG emissions in Jordan; hence, the GoJ has recently launched several projects to place this sector on a greener pathway such as the bus rapid transit and the electric vehicles subsidies and charging stations. Water scarcity is perhaps the most crucial challenge owing to the fact that Jordan is one of the poorest countries in terms of per capita share (MoEnv, 2017). Several green projects are anticipated to lessen the severity of water scarcity in Jordan such as maximizing the reuse of treated wastewater in agriculture, desalination, storm water harvesting, and capacity building at the institutional and societal levels to promote water consumption efficiency principles (MoEnv, 2017). The agriculture sector is a key sector in the Jordanian culture which supplies 19% of the country's food, but this sector is highly inefficient considering its tremendous freshwater demand. The national GG plan acknowledges the sociocultural and economic significance of agriculture and proposes interdisciplinary solutions to increase its efficiency and resilience and decrease its water demand. The waste sector has been recognized as a priority sector due to the steady increase in the waste quantities coupled with the unsustainable waste management practices in Jordan. The waste sector has undergone major improvements over recent years such as adopting the sanitary landfilling approach at several disposal sites and implementing sustainable practices such as composting and recycling at different locations in Jordan. Tourism is a key player in the Jordanian economy accounting for 13% of the GDP. Tourism is an ideal sector for embracing sustainable practices aiming to mitigate the GHG emissions, reduce waste quantities, and increase water and energy consumption efficiency (MoEnv, 2017).

In terms of social sustainability, it can be noted from Fig. 2 that the economic growth over the study period did not fulfill the social sustainability criterion using

the education indicator. It is estimated that nearly 1.5 million students are enrolled in the primary and secondary education in Jordan. Nearly 79% of Jordanian females have received a secondary education or higher compared to 83% for Jordanian males. The declining education rates can be attributed to the increased poverty levels in the Jordanian society resulting in greater financial burdens of children education (clothing, transportation, other expenses). Ultimately, children may drop out of schools, mostly in the secondary education stage, to engage in the labor market and assume some of the financial responsibilities of their families. The Syrian refugee crisis has aggravated the education challenges in Jordan, and it is estimated that the enrollment rate of Syrian children is only 37% compared to 79% overall rate in Jordan. In order to overcome the education challenges in light of the limited and weak infrastructure, the Ministry of Education (MOE) has temporarily rented many private buildings until new ones are constructed, and a double-shift school model was adopted in many regions where students attend school in morning and afternoon periods. Over the long term, the GoJ is planning to secure education to all children regardless of their gender, religion, or citizenship by investing heavily in the education infrastructure such as constructing 300 schools over the 2018–2023 period, rehabilitating 800 schools annually, and remodeling schools to be accessible to handicapped students (MOE, 2018).

On the contrary, the social sustainability criterion has been fulfilled using the employment and healthy life indicators as shown in Fig. 2. The observed economic growth in the final year ($Econ_t$) was 2.57 which is to say that the GDP in the final year was 2.57 times the base year's GDP, whereas the sustainability window limits (SW_{min}, SW_{max}) using these two social indicators were roughly (2.5, 3.7). The fact that the observed economic growth was very close to the lower sustainability limit suggests that the social development was marginal over the study period. The healthy life indicator has increased steadily from 63.5 years in 2006 to 65 years in 2016. Correspondingly, life expectancy at birth has increased from 72.76 years in 2006 to 74.18 years in 2016 (The World Bank Group, 2019b). The difference between healthy life and life expectancy indicators is that the former measures the number of years a newborn is anticipated to live minus the poor health years; thus, the difference accounts for the average number of healthy years lost (SSF, 2017). Generally, the progress in the health indicators, the healthy life and life expectancy, can be attributed to the healthcare advancements, safe sanitation, and food security. Despite the positive social gains of an increased life expectancy, an aging and retired population has its own drawbacks on the healthcare and retirement costs (Savage, 2006). From a global perspective, the average healthy life and life expectancy in 2015 were 63.1 years and 71.4 years, respectively (WHO, 2020). The improvement in the healthy life indicator in Jordan is moderate and is comparable to other countries such as Saudi Arabia, Kuwait, Oman, and Egypt. Nevertheless, the progress in other countries such as Turkey outpaced its counterpart in Jordan. The moderate improvements in the health indicators in Jordan over the study period can be explained by the status of the healthcare sector in the sustainable development strategies, the qualified personnel in the healthcare sector, and the civil health insurance plans which cover a large segment of the Jordanian population. Jordan is in fact one of the primary destinations for medical tourism in the Middle East.

However, more than 85% of the Jordanian elderly suffer from chronic diseases such as high blood pressure, high cholesterol, diabetes, heart diseases, and asthma. The number one cause of death in Jordan is cardiovascular diseases followed by cancer (CDC, 2014; High Health Council, 2016). Smoking is another major health concern in Jordan and according to recent estimates, the overall smoking prevalence in Jordan is 50% which is among the highest in the world (High Health Council, 2016; WHO, 2015), and the highest prevalence is found among the 25–34 age group (The World Bank Group, 2019c). To further progress the healthcare services in Jordan, technical and political reforms are necessary to regulate and enhance the status and working conditions of the medical cadres, and a greater emphasis shall be given to the primary healthcare services, chronic disease prevention, and combating health risk factors such as smoking (High Health Council, 2016).

The employment is possibly the most critical socio-economic indicator in Jordan due to the increased unemployment over recent years and the fact that more than half of the Jordanian population is under 22 years of age. Combating unemployment has always been a headline of the governmental policies, and the economic growth strategies have been centered around creating more job opportunities for Jordanians. Over the study period, unemployment rates have remained in the double digits and the increase in employment was peripheral (from 87.6% in 2006 to 88.9% in 2016). Nonetheless, employment rates have plummeted to 81.4% in 2018 and 80.9% in 2019, which has to do with the fact that unemployment solutions in Jordan are short-term rather than real solutions. For instance, absorbing Jordanian youth into the public sector is a temporary solution and does not resolve the unemployment challenge sustainably. It has been argued that the economic growth over the past decade was insufficient to alleviate the pressure on the domestic labor market. The fact that nearly 9% of Jordanians work abroad is a clear evidence that most created jobs in the Jordanian economy are classic and low-paid rather than challenging and creative opportunities (MOL, 2011). Although the expatriates' remittances share of the GDP is 9%, losing the skillful and highly qualified labor to other economies is a major setback. Besides, most Jordanians would prefer to work in Jordan given well-paid jobs that match their qualifications. Hence, it is necessary to promote new industries and emerging businesses and stimulate the private sector investments in order to create more challenging and diversified job opportunities (MoEnv, 2017). The recent COVID-19 pandemic is predicted to overwhelm the Jordanian economy and labor market, but the lower oil prices provide a glimmer of hope for a gradual recovery on the medium term (The World Bank Group, 2020b). A summary of the sustainability limits and the observed economic growth using GDP as the economic indicator, GHG per capita as the environmental indicator, and employment, healthy life, and education as social indicators is presented in Table 2.

The second SuWi trial (scenario 2), portrayed in Fig. 3, was conducted using GDP as the economic indicator; GHG intensity as the environmental indicator (as opposed to the GHG per capita in scenario 1); and education, healthy life, and employment as social indicators. It can be observed that the economic growth satisfied the sustainability limits over the study period using the healthy life and employment indicators, whereas the economic growth did not fulfill the social sustainability criterion when the education indicator was used, which is the same

Table 2 Summary of the indicators used and the sustainability limits for each scenario

Scenario	Social indicator	Environmental indicator	Economic indicator	$Econ_t$	SW_{min}	SW_{max}
1	Employment	GHG per capita	GDP	2.568	2.530	3.736
	Healthy life	GHG per capita	GDP	2.568	2.508	3.736
	Education	GHG per capita	GDP	2.568	2.769	3.736
2	Employment	GHG intensity	GDP	2.568	2.530	6.017
	Healthy life	GHG intensity	GDP	2.568	2.508	6.017
	Education	GHG intensity	GDP	2.568	2.769	6.017
3	Employment	Consumption	GDP	2.568	2.530	3.095
	Healthy life	Consumption	GDP	2.568	2.508	3.095
	Education	Consumption	GDP	2.568	2.769	3.095
4	Employment	GHG intensity	GDP per capita	1.610	1.587	3.774
	Employment	GHG per capita	GDP per capita	1.610	1.587	2.343
	Employment	Consumption	GDP per capita	1.610	1.587	1.942

conclusion reached in scenario 1. The similarity between the two scenarios can be explained by the fact that both environmental indicators (GHG per capita and GHG intensity) have decreased consistently over the study period which shows that a growing economy did not jeopardize the environmental wellbeing. Factors such as population growth, GDP per capita, energy intensity of the GDP, and carbon intensity of energy are the common drivers for the global rise in GHG emissions (Davis & Caldeira, 2010). In Jordan, GHG intensity (in tCO_2-eq per $1,000 GDP) has decreased from 1.88 in 2006 to 0.80 in 2016, and the per capita GHG emissions (in tCO_2-eq per person) have decreased from 4.79 in 2006 to 3.29 in 2016. The per-capita GHG emissions in Jordan are less than the 2016 global average (4.4 tCO_2-eq per person), and considerably lower than the rates in other nearby countries such as Qatar, Kuwait, United Arab Emirates, and Saudi Arabia (SSF, 2017).

The upper sustainability limits (SW_{max}) were 3.74 and 6.02 for scenario 1 and scenario 2, respectively, which implies that the GHG intensity offers a wider margin for a sustainable economic growth compared to the GHG per capita; thus, the GHG per capita can be deemed a stronger environmental indicator compared to the GHG intensity. This is consistent with Luukkanen et al. (2019) and Abu Hajar et al. (2020) who revealed that the GHG intensity is a weaker environmental indicator compared to the net or the per capita GHG emissions. The energy intensity is another weak environmental indicator which is analogous to the GHG intensity. Xue (2012) indicated that the energy intensity per unit GDP has declined over the past four decades in most countries; however, the environmental gains have been offset by the increasing scale of economies. A summary of the sustainability limits and the observed economic growth using the GDP as the economic indicator, GHG intensity as the environmental indicator, and the employment, healthy life, and education as social indicators is presented in Table 2.

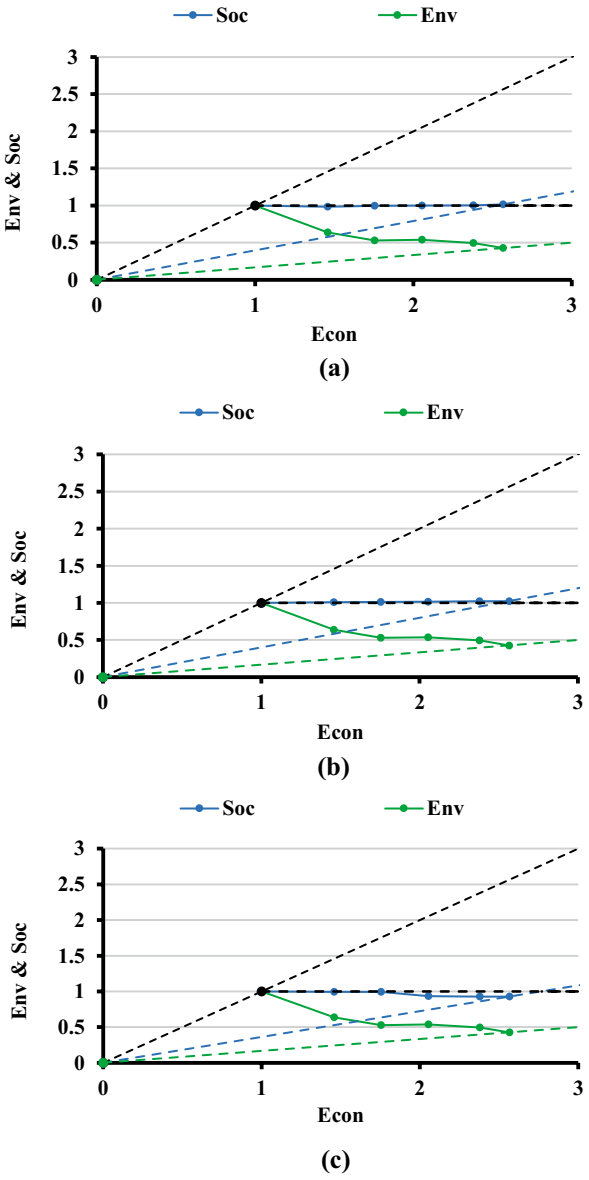

Fig. 3 SuWi analysis (scenario 2) when GDP is the economic indicator, GHG intensity is the environmental indicator, and **a** employment is the social indicator, **b** healthy life is the social indicator, and **c** education is the social indicator

The third environmental indicator explored was consumption, which measures the ecological footprint excluding the carbon footprint (SSF, 2017). The ecological footprint is a firmly established multiscale environmental indicator which measures the consumption of resources and subsequent resource deficiency as a result of anthropogenic activities. Accordingly, the ecological footprint accounts for all bioproductive areas consumed by the human activities while taking into account each country's specific yield for different activities (Jorgenson & Dietz, 2015;

Lin et al., 2018; Nathaniel, 2020). Several factors directly influence the ecological footprint including economic growth, population growth, agricultural activities, urbanization, and industrialization. However, the adverse impacts can be mitigated or even eliminated if the SD principles are incorporated (Jorgenson & Dietz, 2015; Lin et al., 2018; Nathaniel, 2020). For example, the impact of energy consumption on the environment and ecosystems is proportional to the quantity of fossil fuels consumed. Conversely, utilizing renewable energy will lead to decoupling the energy sector growth and the ecological footprint to some extent (Bekun et al., 2019; Nathaniel, 2020; Yang & Huang, 2019). Savage (2006) argued that the rapid population growth is not the real reason behind the environmental and ecological deterioration considering that more than 80% of the world's energy is consumed in industrialized countries which only represent 26% of the world's population. Hence, the real damage to the environment and ecosystems is rather caused by the unequal and capitalistic economic growth.

The ecological footprint encompasses several sub-indicators such as carbon footprint, forest land, cropland, and grazing land (Jorgenson & Dietz, 2015; Lin et al., 2018; Nathaniel, 2020). Despite the fact that carbon footprint is the fastest growing subcomponent comprising nearly 60% of the world's ecological footprint (Lin et al., 2018), the carbon footprint has been tackled by other environmental indicators (GHG intensity and per capita GHG); thus, the consumption indicator covers all ecological footprint subcomponents except carbon footprint (SSF, 2017). Figure 4 illustrates SuWi analysis scenario 3 in which consumption was used as the environmental indicator while the social and economic indicators were not altered from the previous two scenarios. Clearly, the economic growth was within the sustainable growth threshold using the healthy life and employment indicators, while the economic growth was not sustainable using the education indicator, and this conclusion is compliant with the findings of scenario 1 and scenario 2. Over the study period, Jordan's consumption (in global hectares per person) has decreased from 1.2 in 2006 to 1.0 in 2016, which implies that the economic growth was decoupled from the ecological damage. It is worthy to mention that the economic growth would be not environmentally sustainable should the overall consumption be used instead of the per capita consumption, which is a similar argument to the net GHG emissions vs. per capita GHG emissions presented earlier. This is because Jordan's overall consumption (in million hectares) has increased from 7.25 in 2006 to 9.59 in 2016. To put these figures into perspective, the humanity's ecological footprint has been increasing on average by 2.1% per year since 1961, a rate which considerably outpaced the biocapacity increase rate of 0.5% per year. In absolute terms, the global ecological footprint (in billion global hectares) has increased from 7 in 1961 to nearly 21 in 2014, and the corresponding biocapacity has increased from 9.6 in 1961 to 12.2 in 2014 (Lin et al., 2018). The 2014 Jordan's population represented 0.123% of the world's population while the country's consumption was only 0.0411% of the world's overall consumption. The global per capita ecological footprint (in global hectares per person) has increased from 2.29 in 1961 to 2.84 in 2014 (Bekun et al., 2019; Lin et al., 2018). Assuming the carbon footprint accounts for 60% of the ecological footprint, the 2014 global consumption is estimated at 1.14 global

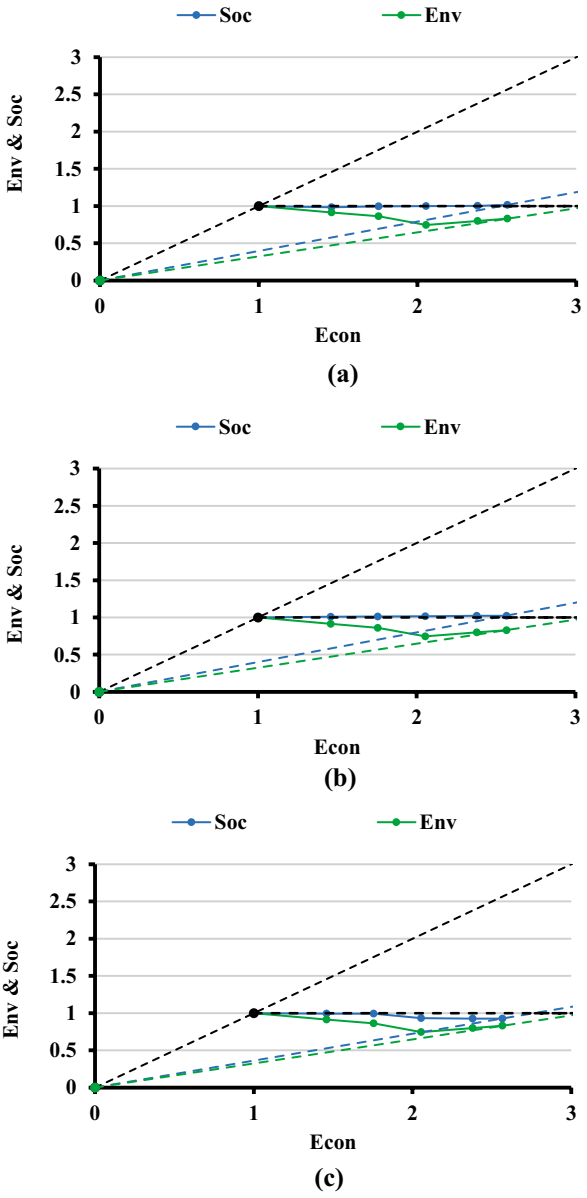

Fig. 4 SuWi analysis (scenario 3) when GDP is the economic indicator, consumption (global hectares per person) is the environmental indicator, and **a** employment is the social indicator, **b** healthy life is the social indicator, and **c** education is the social indicator

hectares per person which is slightly higher than the corresponding value in Jordan for the same year (1.0). The ecological footprint in Jordan has been explored in depth by AFED (2012), and it has been argued that the comparatively little ecological footprint could adversely affect the capacity to meet the basic needs such as food and shelter; however, serving the basic human needs must not come on the expense of biocapacity and ecosystems. Jordan occupies nearly 1.3 million

hectares of productive land and water, 7.5% of which is forestland, 17.7% is cropland, 57.2% is grazing land, and 16.2% is built infrastructure (AFED, 2012). Compared to other nearby countries, the 2016 per capita ecological footprint in Qatar was 11.7 which is nearly six times its counterpart in Jordan. A summary of SuWi analysis scenario 3 sustainability limits and the observed economic growth is presented in Table 2.

The final SuWi analysis (scenario 4) was conducted using the GDP per capita as the economic indicator, employment as the social indicator, and GHG

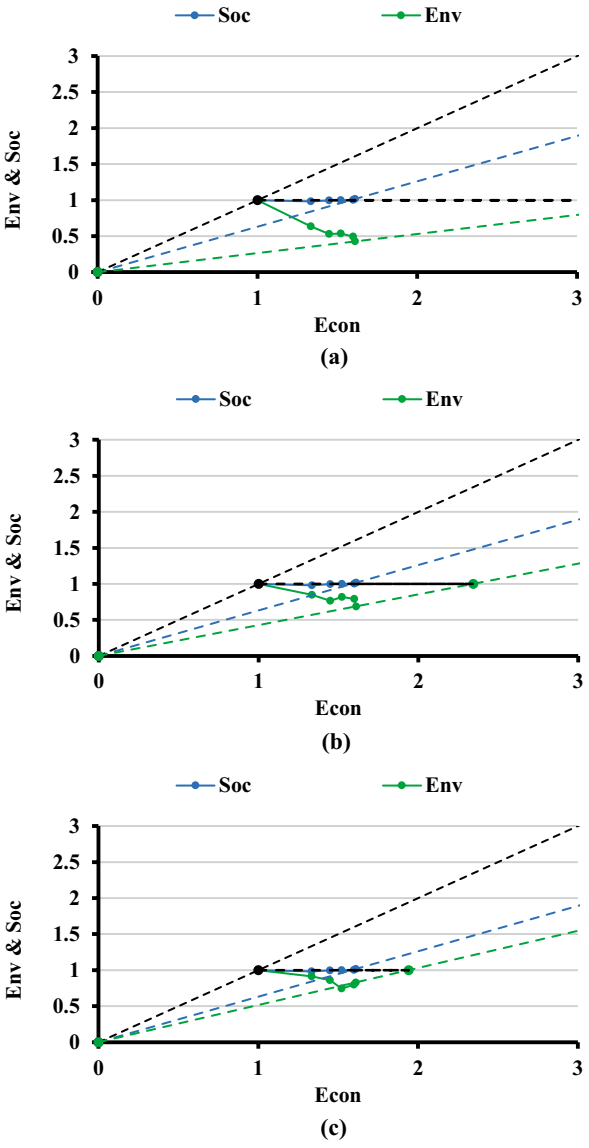

Fig. 5 SuWi analysis (scenario 4) when GDP per capita is the economic indicator, employment is the social indicator and **a** GHG intensity is the environmental indicator, **b** GHG per capita is the environmental indicator, and **c** consumption is the environmental indicator

intensity, per capita GHG, and consumption as the environmental indicators (Fig. 5). It can be concluded that the economic growth over the study period was within the sustainability limits regardless of the environmental indicator. The final year's economic indicator value is slightly above SW_{min} which has been explained earlier by the relatively slow progress of employment rates over the study period. Despite the popularity of the GDP, the GDP per capita has been advocated as a more realistic and legitimate economic indicator. This is because the GDP growth does not necessarily insinuate that the economic well-being of citizens is improving accordingly. The two indicators would yield comparable results for slowly growing populations but the difference can be significant for rapidly growing populations. To elaborate, the GDP of a certain country can grow by 2% while the GDP per capita can decline by 0.5% concurrently (Kopf, 2018). In fact, more than 44% of the Southeast Asia population live under poverty in spite of the positive economic growth measured by the GDP (Savage, 2006). The GDP in Jordan has increased from $15.27 billion in 2006 to $39.20 billion in 2016, while the GDP per capita has increased from $2,548 in 2006 to $4,104 in 2016. The most remarkable economic growth was witnessed between 2006 and 2008 with 46% and 33% GDP and GDP per capita growth rates, respectively. A summary of SuWi analysis scenario 4 sustainability limits and the observed economic growth is presented in Table 2.

In summary, green and sustainable growth is a golden opportunity for Jordan to overcome the barriers of the prevailing growth scheme. An inclusive GG will ensure sustainable and equitable distribution of growth and living standards, decent work and income for all Jordanians, lower pollution levels and GHG emissions, stronger energy security, improved infrastructure, and efficient resource utilization. GG implementation in Jordan might be a long journey and may bear additional expenses compared to the fossil fuel intensive growth; however, the long-term benefits will outweigh the costs and will enhance the country's resilience to external variables and shocks (Dordmond et al., 2020; MoEnv, 2017). To gain the ultimate fruit of GG, it is key to plan and implement clusters of cross-sectoral projects instead of standalone ones. For instance, investing heavily in the tourism sector will likely increase the water and energy consumption; hence, a cluster of water-energy-tourism projects will ensure an equitable distribution of resources and a plausible trade-off between the three sectors for a sustainable and inclusive growth (Abu Hajar et al., 2020; MoEnv, 2017).

The road to a GG in Jordan is not devoid of challenges and obstacles. Perhaps the most profound challenge is the behavioral shift of individuals and institutions concerning natural resources exploitation and the predominant unsustainable models in transport, energy, and tourism. Short-term alternatives with quick and reliable returns are often preferred by decision-makers possibly due to the political instability in the region which has influenced the long-term international investments in Jordan. The political instability in the region has overwhelmed the Jordanian economy as a result of hosting more than 1 million refugees in the past decade besides the substantial impacts on key economic sectors such as tourism and exports. Another key challenge is the real implementation of green projects, since several green growth models and projects have been in circulation for years; yet, the large-scale implementation is to be realized despite the plausible cost–benefit ratios and the alignment of such projects with the national

priorities and needs. Scaling up green projects is often hindered by the overlap of responsibilities and lack of coordination, short-term governmental investment visions, insufficient technical capacities and skills to design and implement green projects, lack of adequate financing mechanisms, low public trust in governmental policies and commitment to strategies, and the ineffective legislation to enable GG and incentivize the private sector involvement (Drimili et al., 2019; MoEnv, 2017). The Renewable Energy and Energy Efficiency Law, which was enacted in 2012, is an example of the GoJ legislation to promote GG in the energy sector. However, a renewable energy project developer will need to engage in contracts and negotiations with many stakeholders including the energy companies, the land owner, the Ministry of Environment, and others. Therefore, major improvements are still desired for Jordan to become a leader in renewable energy and an attractive investment destination, and it is essential to develop and implement transparent governance processes and enforcement mechanisms to promote GG, strengthen the public–private-partnerships, and focus on capacity building and behavioral shifts in the environmental, social, and economic aspects (MoEnv, 2017).

It is also of paramount importance to benefit from other leading countries in GG. Germany, for instance, is one of the most successful countries in decoupling their economic growth from the environmental degradation. This success was the fruit of a long history of resource conservation and environmental protection policy design and implementation. Several strict targets have been set by the German Government for the reduction of primary energy consumption, increasing the share of renewable energy, and GHG emissions reduction. Some of those targets (e.g., share of renewables) were met before the designated deadlines and were revised accordingly. Another feature of the German policies is the high fossil fuel prices compared to other European countries as a result of a tax reform which aimed to enforce high excise taxes on conventional fuel consumption to support Germany's GG agenda. The tax reform led to a gradual increase in energy costs between 1999 and 2003, and consequently the fossil fuel consumption and GHG emissions declined. The increased revenues due to the higher taxes were poured back to tax payers by gradually reducing the social security taxes which created more employment opportunities in the thriving renewable energy industry. The prosperity of the renewable energy sector not only strengthened the German economy, but also enhanced its resilience to external variables and shocks. The key to the success of the German experience was the public acceptance and the legislative entities of the tax reform (Buehler et al., 2011). This is not to say that replicating the German experience will inevitably succeed in Jordan. In fact, Jordan has witnessed public protests in 2018 due to a proposed income tax reform bill, but the GoJ did not successfully demonstrate the rationale and benefits of such reform. Thus, it is believed that more effective and transparent communication channels between the government and the society will increase the chances of public acceptance to legislation and tax reforms for green purposes.

Conclusions and Recommendations

This study aimed at investigating the sustainability of the economic growth in Jordan and the potential to transition the Jordanian economy to a greener pathway. The economic growth over the 2006–2016 study period was examined from a sustainability perspective using the Sustainability Window (SuWi) analysis tool. The success of the SuWi tool depends on the selection of combinations of compatible economic, environmental, and social indicators. The GDP and GDP per capita indicators were used to measure the economic dimension; GHG intensity, GHG per capita, and consumption indicators were used to measure the environmental dimension; and employment, healthy life, and education indicators were used to measure the social dimension. Over the study period, GDP has been increasing steadily from $15.27 billion in 2006 to $39.20 billion in 2016. The GDP per capita, on the other hand, has increased from $2,548 in 2006 to $4,103 in 2016. From an environmental perspective, the net GHG emissions in Jordan have been rising unceasingly; conversely, the GHG intensity and GHG per capita were steadily decreasing over the study period. This suggests that the economic growth was partially decoupled from the environmental deterioration using the GHG intensity and GHG per capita indicators. It has been argued that the GHG intensity and GHG per capita are weaker environmental indicators compared to the net GHG emissions; nonetheless, the latter was not compatible with the other economic and social indicators for the SuWi analysis. Similarly, the environmental sustainability criterion was satisfied when the consumption was used as the environmental indicator.

It was also inferred from the SuWi analysis that the economic growth over the study period satisfied the social sustainability criterion using healthy life and employment indicators; on the contrary, the economic growth was not sustainable when education was used as the social indicator. The declining rates of enrolment in the primary and secondary education in Jordan can be attributed to the increased poverty levels as well as the increased pressure on the overwhelmed education infrastructure due to the latest wave of refugees. The Government of Jordan has adopted short- and long-term solutions to address the education challenges and respond to the increasing demand on the primary and secondary education in Jordan.

Despite the favorable outcomes of the SuWi analysis using most indicators, there are serious challenges that may impede the adoption of green growth in Jordan. The employment rates grew marginally over the study period; however, the past 2 years have witnessed a sharp drop in employment, and it is anticipated that the employment rates will continue to plummet due to the economic downturn associated with the COVID-19 pandemic. Employment is one of the most critical socio-economic challenges in Jordan because more than half of the Jordanian population is under 22 years of age. Thus, it is essential to promote new industries and emerging businesses and stimulate the private sector investments to create more challenging and diversified job opportunities rather than adopting short-term and temporary solutions. The success of green growth in Jordan also necessitates implementing

capacity building programs to facilitate the behavioral shift of individuals and institutions toward more sustainable practices and models in the different economic sectors. Finally, transparent governance processes and enforcement mechanisms are essential to successfully shift the economic growth to a greener pathway by preventing the overlapping responsibilities, strengthening the public–private partnerships, and ensuring equal and fair opportunities for all.

Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing Interests The authors declare no competing interests.

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