

# Sustainable development in Qatar: Challenges and opportunities

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## ABSTRACT

This work outlines the issue of sustainable development in a global context as well as examining the potential for success, in terms of development strategy, in Qatar. The aim of the paper is threefold: Define sustainable development and what pursuing a path of “sustainable development” means for Qatar. Outline the challenges facing Qatar in terms of realizing the vision of sustainable development; and explore currently unrealized opportunities for sustainable development.

*Keywords:* Qatar, sustainable development, green growth, knowledge based economy

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The concept of “sustainable development” must become as much a part of everyday life as the words have become a part of everyday language. However, for local, regional and national organizations, having a clear and comprehensive understanding of sustainable development is critical in order to pursue a sustainable pathway of development. With the publication of the Qatar National Vision 2030 and the National Development Strategy 2011–2016, the leadership of Qatar has outlined the developmental goals for the next two decades, goals that embrace the ideals of sustainable development. However, sustainable development is not merely a goal to be reached. It is a process of uniting, formerly independent, social, economic and environmental policies into a systems approach. This process will continue to evolve as our knowledge and experience increases<sup>1</sup> and our governance and management policies become increasingly adaptive<sup>2</sup> to tackle social-ecological challenges.

Achieving a sustainable society depends on having the tools to measure progress (social, economic and environmental), which requires a transdisciplinary research focus, sound policies and the political leadership and regulatory bodies to implement policy. These tools need to be coupled with a move toward a green economy or green growth.

## SUSTAINABLE DEVELOPMENT

Sustainable development is a path of economic and social development that incorporates, and is not independent of, the natural environment. When considering economic and social development, it is important to realize that the economy and the social aspects of humans take place *within* the environment and are completely *dependent upon* the environment. However, the scale of human activity is now so great that humans can fundamentally affect the functioning of the global environment,<sup>3,4</sup> such that we risk exceeding planetary environmental boundaries resulting in sudden and potentially catastrophic global environmental change.<sup>5</sup>

The challenges presented by human population growth on the ability of the earth to continue to act as a source of resources and sink for emissions re-emerged in the mid 20th century.<sup>6,7</sup> The idea that the earth has a limited carrying capacity was brought to the attention of the greater international community, with the publication of *Limits to Growth* in 1972.<sup>8</sup> The authors were widely criticized at the time for being Malthusian and underestimating the ability of technology and human inventiveness to counter fundamental limits of the earth’s capacities. Publication of the book did initiate the idea of resource limits and begin an international dialogue that lead to the World Commission on Environment and Development (WCED) in 1983. The report of the Commission (commonly referred to as the Brundtland commission from the chair Gro Harlem Brundtland), *Our Common Future*, introduced the idea of sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.<sup>9</sup> It brought to the forefront the concept of interdependence between economic and social development and the environment, which has since been elaborated by Agenda 21 UNCED<sup>10</sup> and the Rio (+20) outcome paper.<sup>11</sup>

Sustainable development is a model of good asset management. While the description of sustainable development in UN reports outlines the concept of sustainable development, it does not set enforceable limits or give political leaders the information or tools they need to make informed decisions and establish policies. The concept of sustainability does provide an outline as to how resources must be managed, as reviewed by Rennings and Wiggering.<sup>12</sup> Three basic guidelines for natural resource use include the following:

- the maximum sustainable yield cannot be exceeded for renewable resources
- emissions can not exceed the capacity of the ecosystem to absorb the waste and
- non renewable resources should be exploited at a rate only as great as the creation of renewable substitutes.

To ensure these conditions are met, a scientific base must be established concerning maximum yields for renewable resources, and critical levels and loads for ecosystem absorptive capacity basic information, which is currently lacking for Qatar.

The mechanism of achieving sustainable development itself has been hotly debated, including whether pursuing sustainability lies with the choices of individuals or institutional and technological advances (reviewed by Robinson<sup>13</sup>). Despite some criticism, it may be most productive to think of sustainable development as an approach to development that “integrates environmental, social and economic issues in a long term perspective”<sup>13</sup> in a way that not only incorporates the interests of markets and business<sup>14</sup> but utilizes them to drive positive changes. In this way, many, if not all,

stakeholders can be included despite potential differences in ideology concerning the why and the way that sustainable development should be pursued.<sup>15</sup>

Hence, sustainable development is economic development that supports social development, or improvement of human well-being, without compromising the fundamental environmental and cultural framework in which it takes place, thus ensuring intergenerational equity.

More recently, UNEP has gone further in outlining how transforming to a “Green Economy” (GE) or “Green Growth” (GG) will fundamentally revitalize the global economy while protecting social and environmental interests with a mere 1–2% of GDP investment.<sup>14</sup> Green growth or green economy will fundamentally tie together economic growth and environmental management or development. Thus, rather than economic, environmental and social pillars of sustainable development, environment and economic growth are intrinsically tied with environmental development being at the core of economic growth.

### **NATIONAL CAPITAL AND SUSTAINABILITY**

One way in which to approach sustainable development is to analyze a nation's capital wealth (on which further development depends) and the transformation of natural capital.<sup>16,17</sup> As any good businessman knows, the rule to survival is that you live off the interest on capital and never deplete your capital. A nation's wealth is comprised of natural capital (renewable and non-renewable resources (sources) and the absorptive capacity of the earth (sink)), produced capital (built infrastructure), human and intellectual capital (knowledge and skills) and institutional capital such as social and legal institutions. While there is no sustainable use of non-renewable resources, there can potentially be sustainable development of economies dependent on such resources, if natural capital is used to develop other forms of capital of equal value. In economics, this is referred to as Hartwick's rule<sup>18</sup> and is the basis of weak economic sustainability. For weak sustainability to be realized all resource rents (or profits from natural resources) need to be properly invested. However, the assumption that other forms of capital can replace natural capital, not only as a form of wealth generation, but also in social and cultural respects is a contentious assumption. Weak sustainability depends on the *elasticity* of substitution and many authors would argue that natural capital, cannot be substituted by other forms of capital,<sup>19,20</sup> especially in the case of supporting services.<sup>21</sup> In the case where natural capital, in the form of renewable resources and select non-renewable resources such as recyclable metals, is maintained or even enhanced, strong sustainability is possible.<sup>22</sup> Net capital depletion is fundamentally unsustainable of which we are at increasing risk, in large part due to climate change and biodiversity loss.<sup>23,24</sup>

The wealth of high-income countries lies largely in the skills and knowledge of the population as well as the institutions that support society. The World Bank<sup>16</sup> suggests that investment in sustainability is not simply built asset accumulation. Rather, technological advancement, institutional strength and other aspects of social capital are critical in advancing the economy and supporting labor. These include assets such as a transparent judicial system, effective governance and well-defined property rights. In the case of Norway, in the period of 1985–2004, resource rents from oil and gas varied greatly depending on the market price, and resource rents from non-renewable resources were negative. It was the return on human capital that was the greatest contributor to net national income. This indicates how resource rents from natural capital can be used to ensure sustainability by contributing to the development of human capital.<sup>25</sup> In the case of Qatar, pursuing a knowledge-based economy has been at the forefront of its stated development strategy.

### **MEASURING PROGRESS TOWARDS SUSTAINABILITY**

Measuring the *wealth* of a country when considering sustainable development requires the use of new indicators. Until recently, the most common way of measuring the wealth of a country is to use gross domestic product (GDP). An increase in GDP of a nation is often equated to an increase in the well-being of its' citizens. However, GDP is merely a measure of the goods and services consumed in a country in a given period<sup>26</sup> and was not designed to measure any aspect of welfare or sustainability.<sup>27</sup> GDP is a measure of money that was spent, with no accounting of the cost or benefit of the expenditure for society. It does not account for environmental degradation, natural disasters, illness, crime, social injustice or other costs to society that often increase with economic development.<sup>28</sup> A natural disaster may result in an increase in the GDP as money is spent on recovery. Hence, consumption, as measured by GDP, does not equate to well-being.<sup>20</sup> Neither does income equate to well-being. In an international

study, above approximately \$15,000 per capita per year, happiness does not increase with income. Countries such as Iceland, Switzerland, Denmark and the Netherlands have a higher happiness index but a lower per capita income than the United States. Puerto Rico, with a per capita income half that of the USA, has a comparable happiness index.<sup>29</sup> Efforts to regulate the market to promote social well-being have resulted in increased happiness.<sup>30</sup>

Social well-being can be measured through other indicators such as the Global Peace Index and the Human Development Index. Consider the Global Peace Index.<sup>31</sup> In 2008, Qatar ranked 33 out of 140 countries and in 2013 ranked 19 out of 162 countries, with a score moving from 1.56 to 1.48, showing a general increase in peacefulness. The score is calculated using indicators comprising 60% for internal peace and 40% for external peace. Internal peace indicators include, level of distrust among citizens, measures of criminal activities and access to weapons as well as others. The external peace component includes indicators such as, military expenditures and relations with neighboring countries. Although we must consider that peace can be caused by both negative and positive factors,<sup>32</sup> the GPI still presents an important measure to life quality. Similarly, the Human Development Index (HDI)<sup>33</sup> captures the development of a country incorporating more than income. The HDI considers life expectancy, adult illiteracy and education enrollment, all measures of human capital, in addition to income. Although the HDI does not consider aspects of the environment it does provide a greater understanding of human well-being, more so than income or GDP alone would provide. Some may argue that HDI does not offer more insight than income levels,<sup>34</sup> the HDI provides particularly interesting country comparisons for Qatar. The 2008 Human Development Report HDI (based on 2005 data) for Qatar is 0.88, with 1.00 being the maximum. This placed Qatar 35 out of 177 countries with a per capita GDP of \$27,800. Interestingly it was just above Uruguay (0.85) with a per capita GDP of \$10,200. Other indices in the report, such as the gender development index, ranked Qatar 84 of 93 countries with a score of 0.374 out of a possible 1.00. Similarly, in 2012 Qatar ranked 36 with a per capita GNI of \$87,478 placing it in the very high human development category. Overall there has been an increase in the HDI for Qatar since 1980. The relatively low score on the HDI, given the tremendous financial resources of the country, may be attributed in part to the paternalistic society where women and children are generally disadvantaged.<sup>35</sup> In 2012, Qatar ranked 117 for gender inequality and had scores indicating a lower life expectancy and years of schooling.<sup>36</sup>

The failure of GDP or measures of income as indicators of well-being has resulted in the development of alternative indicators that begin to account for welfare, environment and sustainability. One alternative indicator, the Index of Sustainable Economic Welfare (ISEW), was first calculated in 1989 for the United States.<sup>37</sup> Since then, similar indicators have been developed such as the Genuine Progress Indicator (GPI), Sustainable Net Benefit Index (SNBI) and the Measure of Domestic Progress (MDP).<sup>27</sup> In general, these indicators begin with basic personal consumption data (like the GDP) and add the services that improve human well-being, such as volunteer work, childcare and expenditures on education. Subtracted are the expenditures that decrease well-being as a result of environmental degradation, such as air and water pollution or social costs including crime and family breakdown.<sup>27,38</sup> The GPI and ISEW calculated for the USA from 1975 – 2000 shows a general stagnation or slight decline in GPI at both a national and per capita level.<sup>28</sup> This suggests that while GDP increased throughout the time period, human well-being or quality of life began to decrease. Although the methodology of indicators is still being refined,<sup>27</sup> they provide important information on development and social welfare. The indicators GPI, ISEW and the Environmental Performance Index (EPI)<sup>39</sup> have been calculated for over 100 countries. Unfortunately, as of 2006 none had been calculated for Qatar on account of 'unavailable data'. By 2014, Qatar was included in EPI calculations and ranked 44 out of 178 countries ranking lower, for example, in the category of air quality.

The recent, large-scale use of the *genuine savings* indicator suggests its strength and future use as a major sustainable development tool for policy makers. In *'Where Is The Wealth of Nations?'*, the World Bank<sup>16</sup> addressed the issue of the wealth of nations by analyzing the different forms of capital in developed, developing and middle income countries. The important development in this publication was the use of the measure *genuine savings*, an indicator of the true savings of a country and an important indicator in guiding development policy.<sup>34,40</sup> Genuine savings are the net savings of a country minus the depreciation of natural capital.

The success of resource rich nations depends on careful management of the resources. Studies of human and natural capital suggest that many resource rich nations suffer what is called "Dutch disease", "resource curse" or the "paradox of plenty".<sup>41</sup> Although there is still some argument about the

basis behind this correlation,<sup>42</sup> the phenomenon has been well documented. In the cases presented World Bank,<sup>16</sup> natural resource abundance may result in a highly valued currency, which may inhibit development of export markets. Abundant, but fluctuating cash resources may hinder economic management and reform, while destabilizing the political structure. Resource rich countries like Nigeria had a genuine savings rate of  $-34\%$ , Saudi Arabia  $-27\%$ , Kazakhstan  $-29\%$  and Kuwait  $-13\%$  illustrating a net consumption of capital at the expense of future generations for the year 2000. Those countries that had mid to low HDI values, indicating a lack of development of human capital, were also most likely to be unsustainable.<sup>34</sup> Unfortunately, data for Qatar was unavailable. However in the intervening years genuine savings has increased in general for the Middle East region, with  $-1.80$  Adjusted Net Savings for Saudi Arabia in 2008.<sup>43</sup> Genuine savings, as an indicator of weak sustainability, cannot be consistently negative if sustainable development is to be achieved.<sup>44</sup>

A mix of indicators should provide guidance on policy decisions<sup>45</sup> as government defines the framework under which industry will operate. Only when we obtain an accurate assessment of the social and environmental costs, the true cost of a development project, action or policy, can we pursue actions that will ultimately result in more good than harm.<sup>1</sup> Given this, UNEP has developed a series of Green Growth or Green Economy indicators to support country efforts in designing and implanting Green Growth initiatives. They include measures that assess natural assets, resource productivity or intensity, environmental life quality and GG/GE policies and opportunities.<sup>17</sup>

Qatar has made initial strides towards developing indicators. In 2006 the Planning Council-General Secretariat published "Sustainable Development Indicators in Qatar". In line with the 2030 Vision, a comprehensive effort has been made to collect data necessary for the indicators. They consist of social (26) economic (17) and environmental (11) indicators for a total of 54 measures as recommended by the UN Commission on Sustainable Development. By 2014 The Qatar Statistics authority was able to provide on-line basic information of environmental characteristics, such as the number of days exceeding the national air quality standards by year and details of air emissions and water use<sup>46</sup> and has made sustainable development indicators available in a recent publication.<sup>47</sup> Despite this, there has not been a consolidation of the measures that illustrate the inter-relatedness of the three components. This is a global weakness of indicators such as these. An important next step would be to combine these indicators into one internationally recognized sustainable development indicator. Global indicators could then be used to measure Qatar's progress and compare this with that of other countries. This is particularly important given that currently Qatar has the world's largest ecological footprint of 11.68 global hectares (gha), a measure of the amount of global land required to support the consumption and waste of the Qatar population. Compare this to 3.99gha for Saudi Arabia and 8.44gha for the United Arab Emirates.<sup>48</sup>

## CHALLENGES TO SUSTAINABLE RESOURCE USE IN QATAR

When considering the oil and gas industry, sustainable development does not mean "sustaining the production of oil and gas indefinitely".<sup>49</sup> Climate change will fundamentally affect the oil and gas producing GCC countries.<sup>50</sup> Climate change, arguably the most pressing environmental issue, is a result of fossil fuel use and CO<sub>2</sub> release. This threatens not only biodiversity and ecosystem services, locally and globally, but the lives and livelihood of hundreds of millions of people. While Qatar may be criticized for contributing to climate change by promoting and profiting from the sale of fossil fuels, it is important to note the role Qatar plays in global sustainable development. Fossil fuels differ widely in quality and carbon content. As outlined in Common and Stagl,<sup>22</sup> one tonne of coal will produce 29 gigajoules (Gj) of energy, a tonne of oil 42 Gj and 1 tonne of natural gas 55 Gj. While varying in energy content coal, oil and gas also differ in their carbon content (or CO<sub>2</sub> emission potential). Coal will produce 24.1 kg of carbon per Gj, oil 18.6 kg of carbon and natural gas 14.6 kg of carbon. Therefore, Qatar plays a large role in supporting global sustainable development by providing the cleanest fossil fuel, high quality energy source, as the world moves towards renewable sources of energy.

To consider whether the current developmental path of Qatar is sustainable, we must look at how the financial wealth from the consumption of non-renewable and renewable resources is leading to the development of the country. The latest statistics from the Qatar Statistics Authority<sup>46</sup> reveal interesting changes. From GDP estimates, fishing and agriculture increased by approximately 40% from 2009–2013, mining and quarrying (which includes oil and gas extraction) increased by over 50%, while accounting for approximately 40% of GDP. Note that in 2008, mining and quarrying accounted for over 60% of total GDP. From 2010–2013, manufacturing increased by 22%, electricity and water by

21% and construction 27%, all of which are indicative of increasing pressure on environmental and social aspects of human well-being. The increase in manufacturing is particularly interesting given that the Qatari population suffers disproportionately from asthma,<sup>51</sup> a respiratory disease largely triggered by decreases in air quality. It has been recognized that environmental integrity is key to promoting overall health of a population.<sup>52</sup> Qatar is promoting large-scale manufacturing and production of petrochemical derivatives in an attempt to diversify the economic base independent of oil and gas. Superficially, with the increase in manufacturing it appears as if the economy is diversifying. However, large-scale manufacturing relies on imported base material and manufacturers are enticed to Qatar with the promise of cheap energy, while the production of petrochemical derivatives ultimately depends on oil supplies. Qatalum, a joint venture of Hydro Aluminum and Qatar Petroleum constructed a \$6 billion aluminum smelter in Mesaieed Industrial City (MIC) with production beginning in October 2009. This project is considered a category A project “... *that is likely to result in significant adverse environmental impacts that are sensitive, diverse or unprecedented*”.<sup>53</sup> In the energy intensive aluminum industry, energy availability is critical and was one of six key factors in site selection for Qatalum.<sup>53</sup> In a case such as this, the industry is fundamentally based on the availability of subsidized energy resources and cannot be considered a diversification of the economy. However, some may argue that producing aluminum in Qatar using natural gas is globally advantageous, rather than producing it elsewhere using oil and coal, although aluminum production has traditionally been sited near sources of hydropower.<sup>54</sup>

### SUBSIDIZING DEGRADATION

Traditionally, the market has been viewed as a way to achieve allocative efficiency and the governments' role has been largely underestimated. Governments play an important role in regulating markets in order to eliminate market failures, such as imperfect competition and monopoly or monopsony. Those who subscribe to the Adam Smith philosophy may tout the *invisible hand* model, not realizing Adam Smith recognized that government has a strong role to play, especially in the case of market failures, such as externalities.<sup>55</sup> When we consider sustainable development, the most critical market failures are externalities. Externalities are unintended external effects that may be either good or bad, but they are *external* to the market price (described by Common and Stagl<sup>22</sup>). Externalities include pollution. In the case of fossil fuel, society bears the cost of fossil fuel use including climate change, decreased air quality, decreased water quality, increased disease incidence, etc. These costs are not incorporated into the price of a liter of fuel and therefore, society consumes more than would be expected if the cost were internalized into the market price. This over-use results in environmental degradation. The role of government is to implement policies such as taxes, regulations or emission permits, that result in the internalization of external costs.<sup>56</sup> Many European countries have tried to correct this market failure by taxing fuel use heavily. This has resulted in greater product efficiency and provided funds for healthcare and environmental clean-up. In 2012, the cost for a liter of fuel in Qatar was \$0.27 (USD), while the cost in the UAE was \$0.47, Iceland \$1.99, Norway \$2.53 and Jordan \$1.44 ([worldbank.org](http://worldbank.org)).

While externalities are a market failure, subsidies can be a failure of policy. Depending on how they are applied subsidies can promote environmental protection or promote environmental degradation. Government subsidies may take the form of grants and loans, minimum price guarantees, support for infrastructure, tax exemptions or material and energy inputs.<sup>56</sup> When subsidies are applied to water and energy, they encourage over-use of the resource by artificially decreasing the price, thereby promoting environmental degradation. Subsidizing manufacturing by providing energy resources at below market costs results in over-use of the resource, decreased efficiency, fewer technological advances and greater environmental degradation. Subsidy reforms are taking place in the majority of OECD countries in order to normalize the market. Although in 2000, select OECD countries were still subsidizing the coal industry (the least efficient and most polluting fossil fuel) with billions of dollars.<sup>56</sup>

Currently in Qatar, non-renewable hydrocarbon resources are being used inefficiently and there is a net capital loss as there are fewer resource rents to be reinvested. It is important to review the policies of Qatar concerning hydrocarbons. While subsidies may be useful for attracting industry and expatriate labor, it is at the expense of the environment, the health of citizens and ultimately at the expense of Qatar. With the price of fuel at \$0.27/liter (compared to \$2.14 for the UK for March 2014 ([www.gov.uk](http://www.gov.uk))) Qatar is practically giving away its resources. The International Energy Agency ran a simulation to look at the effect of removing energy subsidies in eight countries where subsidies average 21%. The results



showed that the effects of removing subsidies were “an average increase in GDP of 0.76%, a 13% decrease in energy consumption and a 16% reduction in CO<sub>2</sub> emissions” (reviewed in Barde<sup>56</sup>).

The price of electricity and water are also subsidized for all residents in Qatar providing a serious challenge for developing sustainable resource use.<sup>57</sup> The price of water is currently at \$1.2/m<sup>3</sup> and \$0.02/kWh for electricity for residential purposes in Qatar ([www.kahramaa.com.qa](http://www.kahramaa.com.qa)) compared to \$0.22 kWh for residential use in the UK ([www.gov.uk](http://www.gov.uk)). We can compare the prices to 2005 data on electricity consumption (kWh) per capita among nations. For Qatar the per capita consumption (kWh) was 16454, USA 13640, UAE 12412 and the UK 6254 (International Energy Agency, 2008). It is important to note that Qatari citizens do not pay for water or electricity and resident workers water is subsidized, paying approximately 1/3 the cost of production.<sup>57</sup> This is especially important in that nearly 96% of the municipal (industrial and residential) water supply is produced by desalination<sup>58</sup> and 74% of groundwater supplies remaining are used for agriculture.<sup>59</sup> This is the case even though agriculture accounts for 0.1% of GDP.<sup>46</sup> For all practical purposes the renewable water resources are depleted.<sup>58</sup> In the case of water, Qatar has “turned a water problem in an urban area, into an energy-greenhouse-climate change problem by solving the water problem with desalination fuelled by high fossil fuel energy use and carbon dioxide release”.<sup>60</sup>

### A NEW MODEL

Sustainable development is not only an issue of health, well-being and longevity, it is a fundamental issue of security.<sup>61</sup> Qatar, unlike many countries, has the opportunity and the ability to “leapfrog” in its development pathway, because it is developing quickly at present, has abundant resources and bold leadership. Qatar has the ability to “design” the country sustainably. Most countries have gone through a time of environmentally damaging, natural resource based industrialization to emerge later with a knowledge and technology based economy.<sup>62</sup> When we consider sustainable development, a common question is whether countries can “leapfrog” or skip over the natural resource based phase and move directly into a knowledge-based economy. Over the time period of 1980–2011 the carbon intensity of the economy, in terms of consumption and flaring from fossil fuels, in the United States nearly halved from 0.819 to 0.413 metric tons of CO<sub>2</sub> per \$1000 US dollars of GDP. From 1980–2011 the carbon intensity in Qatar dropped from 1.059 to 0.537, or which highest values are in the early 1990’s<sup>63</sup>. This is indicative of both an increase in productivity and improvements in technology, as well as a shift away from manufacturing and a move toward a knowledge and service based economy. Qatar has the largest CO<sub>2</sub> emissions per capita (44 metric tons, Energy Information Administration<sup>63</sup>) and one of the activities associated with industry that is particularly polluting is flaring. Qatar is beginning to address this problem by joining the World Bank’s Global Gas Flaring Reduction program, the first GCC country to participate.<sup>64</sup>

However, shifting the current developmental pathway of Qatar requires a concerted reform movement, or else the window of opportunity will close. Using the reform model presented by Brewer et al.,<sup>65</sup> we can outline the process:

- Work with a systems approach
- Establish clear goals
- Incorporate Goals into clear standards
- Assess National Progress
- Monitor progress and make adjustments
- Encourage change at all levels

China formally embraced the circular economy model or closed loop material flows model, commonly known as industrial ecology, in 2002. The Chinese model involves three levels of action from the micro, meso to macro levels. It begins with individual plant redesign to developing eco-parks where multiple industries trade wastes and resources while conducting research and development. This is then promoted at the city and province level, with the development of green cities and provinces.<sup>62</sup> In fact, greening of the economy can provide great financial opportunities.<sup>22,55,66</sup>

One of the challenges for maintaining sustainable development in Qatar is to translate the national goals of sustainable development to individual development projects. Currently, development projects are assessed through the Environmental Impact Assessment (EIA) process, a process developed before the move towards sustainable development. The current EIA process incorporates goals of environmental, social and health effects of development projects. However, if EIA’s are meant to be a significant tool in attaining sustainable development, then the EIA process must specifically

address sustainable development goals and criteria.<sup>67</sup> Sustainability assessment can provide decision makers with the information they need in making choices to move society toward a sustainable society.<sup>68</sup>

Does the current pattern of consumption in Qatar threaten the current generation as well as the ability of future generations to provide for themselves? In the case of Qatar, tremendous oil and gas, non-renewable resources, are driving the current economic boom. Therefore, *extraordinary* effort is required to ensure that the benefits of the non-renewable resources are available for generations to come. The economic boom is largely supported by imported human capital. Therefore Qatar must focus the rents from non-renewable resources to developing local human capital.

With the fastest growing economy in the Arab world and the world's third largest gas reserves, Qatar's GDP has been growing at an annual rate of 18% between 1999 and 2004 but has slowed significantly since then, with growth between 2004 and 2012 averaging 14% and just 6% in 2012.<sup>69</sup> Crude oil and gas account for a disproportionate amount of the Qatari GDP. Despite this unprecedented growth, real GDP growth has actually decreased an amount of double-digit inflation rates.<sup>70</sup> In terms of human capital, in the oil and energy sector alone, the Qatari population is not large enough to support the labor demand and it is unlikely they will be able to meet that demand in the future.

One increasing challenge that Qatar is facing is the exponential increase in imported labor. The large increases in population significantly impact the local environment, such as housing, waste disposal, water and transportation must be provisioned. It also impacts the social and cultural norms of Qatar, rapidly changing the face of Qatar.<sup>71–73</sup> In 2006, population statistics recorded a population of nearly 835,000, but by early 2014 that number had reached 2.1 million<sup>46</sup> giving Qatar the highest population growth rate, of 15% between 2005 and 2010.<sup>74</sup> To accommodate such a population, without putting at risk the capital of Qatar, requires an immediate and innovative urban plan designed for the long-term development of Qatar. Such a plan would address housing, transportation, water use efficiency and the protection of land and other natural resources. Award winning sustainable city design is not merely a product of established western localities. The Indian state of Goa, was one of three entries out of 60 competing, that won the special jury prize in the International Gas Unions competition of future sustainable urban design in 2004.<sup>75</sup> The design was produced in just 27 months and included all aspects of urban design including transportation, energy resources, food production, water resources and housing. Importantly it also outlined how the area would *transition* from its current design.<sup>75</sup> This was just one model and there are a variety of models available serving as guides for decision makers globally.<sup>76</sup>

The urban area surrounding Doha has expanded to nearly encompass Shahaniya in the west and Wakrah in the South. This “urban sprawl” is quickly reducing the amount of land available for the provision of local species, ecosystem services and cultural activities. A rallying cry for urban planners could be “Keep Doha in Doha”. Prior to 2000, 50,278 buildings for living purposes had been constructed in Qatar. However between the year 2000 and 2004 an additional 20,658 living accommodations were built and between 2004 and 2010 a further 38,215 living accommodations were constructed all illustrative of the pressing demands of the population rise.<sup>77</sup> Approximately 40% of the population live in villas.<sup>77</sup> While large villas may be necessary for traditional Arabic families, they may be unnecessary for other nationalities, which comprise the majority in Qatar. The provision of more efficient housing would protect the terrestrial ecosystem by requiring less land, protect air quality, as less energy is consumed, and improve well-being if constructed close to work. They may also be more attractive to expatriates as they would be cheaper to maintain, in terms of air conditioning in the summer or heating costs in the winter. Attractive, quality housing constructed close to work is especially important for well-being since commuting to work greatly increases chronic stress among workers.<sup>78</sup> If transportation of people and goods were to incorporate rail transport, great savings could be made. Trains are incredibly efficient for transportation (about six times more efficient than automobiles) and 10–15 times less polluting.<sup>45</sup> Finally, although the central area of Doha is quite small, walking and cycling, (which would likely be acceptable for 9 months of the year) is not currently supported by sidewalks, cycling paths or appropriate crosswalks at most major intersections. However, with the awarding of the 2022 FIFA World Cup to Qatar, significant changes in the availability of public transportation are expected, including a rail network linking the major cities of Qatar as well as serving commuters needs within Doha. As Qatar embarks on preparations for the World Cup with a commitment to a sustainable and carbon neutral Cup, we may look forward to innovative housing and transportation solutions to be implemented.



## STEPS TOWARD A KNOWLEDGE BASED ECONOMY

Science and technology are the basis of sustainable development. Advances in chemistry, materials science, and biotechnology will ultimately lead to industry producing more with less.<sup>62</sup> However, there is no need to delay. Globally, we have the technology to be at least 4 times more efficient, and most likely 8 times more efficient than we are currently.<sup>79</sup> Yet there have been few incentives provided by government to improve efficiency. Governments establish the “rules of play” for business and until those rules are established for all players, individual businesses will struggle to compete developing green technologies or processes.

However, a knowledge-based economy cannot develop without free and open access to all knowledge. Qatar, like many countries, faces challenges when faced with implementing the structural changes necessary for sustainable development. If we look at the environment for doing business in Qatar, the economic freedom rating for Qatar was 62.21 out of a possible 100 points, just making it into the “moderately free” category in 2008, ranking 66 out of 157 countries ranked. This was behind Bahrain, Kuwait, Saudi Arabia and the United Arab Emirates.<sup>80</sup> However, by 2014 Qatar ranked 30 out of 178 countries in the ranking, with 71.2 points out of a possible 100, behind Bahrain and the United Arab Emirates but above the regional average.<sup>81</sup> This index incorporates 10 aspects of the business environment categories such as property rights, financial, investment and business freedom. As discussed by Howarth and Wilson,<sup>82</sup> fundamental to sustainable development are the basic practices associated with democratic decision making. These include, “open discussion, transparency in decision making, debate and the accountability of policymakers”. The shift to a knowledge and science-based economy will require the type of business environment that encourages new thinkers, open access to information and the base of local knowledge. Providing government standards, EIA methodologies and local research in English is an important component of this knowledge development as the international language of science is English.

The future wealth of Qatar will depend on the strength of its human capital. Qatar is especially unique in the development of education since it was only in the 1950’s that government services developed, including schools.<sup>65</sup> This suggests that many current students are the first or second generation of Qatari to be formally educated. Among Qataris age 50 and over, 34% of men and 60% of women have never been to school.<sup>83</sup> That trend is changing. In 2001, RAND corporation was approached to redesign the current education system at the primary, preparatory and secondary levels. Beginning in 2002, institutional, regulatory and school reform began. This included the implementation of curriculum standards in Arabic, English, science and mathematics, and training programs for teachers with a new independent school model. While there have been impressive improvements, some problems remain to be addressed within the school system. The QCEA standardized tests were first administered in 2005 and average proficiency levels among Ministry schools were as follows: Arabic 3%, English 1%, Mathematics, 0% and Science 0%.<sup>65</sup> QCEA testing performed in 2006 showed little improvement and indeed some backsteps as the country moves to revitalize the school system.<sup>84</sup> By 2010/2011, 13% of students were able to meet standards.<sup>83</sup> The rapid rise may reflect a true performance increase or changes in the standardized testing. Schools continue to struggle to meet newly established standards, with independent schools in general performing better than ministry schools.<sup>85</sup> There was the intention to convert all ministry schools to independent schools<sup>86</sup> and enforce teacher licensing and standards comparable to western systems.<sup>87</sup> Controversial amongst parents, students and educators, the import of such systems and standards may result in better progress in the future. In particular, schools pursuing student-centered learning or inquiry-based learning in mathematics and sciences in Qatar have been shown to be more successful.<sup>88,89</sup> To date, the state of the school system remains in flux with fewer students pursuing mathematics and science subjects.<sup>83</sup>

There are marked differences between the educational achievements of men and women in Qatar. In post-secondary education, Qatari women achieved more when compared to men. Seventy-one percent of Qatari women reported having a university degree compared to 36% of Qatari males,<sup>90</sup> with a clear distinction in what areas women and men pursued. In addition only 58% of males actually complete their degree.<sup>90</sup> However, the males surveyed reported an 88% employment rate, but only 54% of women were employed.<sup>90</sup> This may be attributed to the traditional role of women, and the desire for women to work in an environment where they are not working with men. Therefore, the strengths of Qatari women are not being fully realized. This also suggests possible workplace modifications that would accommodate traditional and cultural needs and lead to greater incorporation of women in the workplace. Secondary school seniors who were surveyed showed

similar trends. In 2008/9, female students consistently scored higher in the sciences for the Qatar Senior School Certificate.<sup>83</sup> Sixty percent of females planned to pursue a higher education, but only 15% intended to work. Thirty seven percent of males planned to pursue higher education, but 50% of males planned to work after graduation.<sup>91</sup> Very few pursued employment in the private sector, preferring to work in government positions. This may be related to generous benefits provided to employees in government positions as well as a lack of skills that are required by the private sector.<sup>92</sup> The Third National Human Development Report for Qatar<sup>93</sup> has outlined specifically the challenges facing Qatari youth and the ways in which such challenges will be addressed.<sup>83</sup> Ironically, greater educational attainment of women also makes them more likely to get divorced, which makes them and their children more likely to fall into poverty, which may then further limit the children's educational attainment.<sup>83</sup> The challenge remains, in order to develop a knowledge-based economy we must first develop the knowledge base.

Qatar has embraced the idea of developing a knowledge-based economy and successful steps have been implemented.<sup>94-96</sup> One example of this is the support of human capital development in the founding of the Qatar Foundation in 1995 with a fund of \$2 billion and in 2009/10, education accounted for 13% of government expenditures.<sup>83</sup> Qatar Foundation supports education, research, capacity building and open dialogue at all levels, supporting activities such as the Doha Debates and Al Jazeera television station. Al Jazeera, an overwhelmingly successful Arabic language news channel, has provided a forum for open discussion and criticism.<sup>97</sup> At the postsecondary level, there are many new opportunities for students in Qatar. Qatar University offers a variety of degrees including most recently, environmental studies. The College of the North Atlantic and the University of Calgary also offer postsecondary programs in Qatar. Education City is an important addition to the educational opportunities in Qatar providing an international education for Qataris and non-Qataris alike, attracting students from the region and beyond. Education City is comprised of branch campuses of Virginia Commonwealth School of the Arts, Carnegie Mellon (business and computer science), Texas A&M (engineering), Georgetown (foreign service), Weill Cornell Medical College (medicine) and Northwestern (journalism and communication). In addition, the scholarship system is undergoing reform to increase the benefits obtained from students studying abroad.<sup>98</sup> Recent emphasis has been placed on developing opportunities for students in trade, technical and vocational training to better meet the needs of students who do not choose to pursue higher levels of education.<sup>83</sup> Research and development are supported by the Qatar Foundation with the establishment of the Qatar Science and Technology Park (QSTP) and the Qatar National Research Fund (QNRF). Qatar is also making strides in developing ICT to create that knowledge-based economy, with initiatives in healthcare and education, as well as government.<sup>99</sup> In 2006, the Emir announced that Qatar would spend 2.8% of GDP on government supported research. This is comparable to western nations, in which natural capital makes up a smaller portion of the national capital.

## REDESIGNING INDUSTRY

Resource scarcity and the move toward sustainable development has led to fundamental shifts in how we think about industry, production and consumption. This has led to the emergence of industrial metabolism. Industrial metabolism, which is comprised of a variety of sub-areas, is a way of modeling the world as an organism or as a cell. So industrial metabolism will address the system as a whole, including aspects of transportation, etc.<sup>100</sup> Industrial ecology is a way of modeling industry as an ecosystem with producers and consumers, where no resources are wasted and industrial symbiosis is obtained, this is particularly relevant to Qatar. Industrial symbiosis is concerned with maximizing resources in an area where multiple industries are co-located, the model of which is Kalundborg, Denmark.<sup>101</sup> In this case, wastes from one industry serves as the resources for another. Qatar has the opportunity to fundamentally influence the sustainability of the globe as a whole, by influencing the global gas sector. With the world's third largest gas reserves and the infrastructure to exploit those reserves, Qatar can enforce standards that promote technological advances. Those advances can then be adopted globally. This may include designing an industrial symbiosis model, which could be developed in Ras Laffan Industrial City and Mesaieed Industrial City. Following an industrial ecology model, wastes such as sulfur and flare gas, could be utilized by other industries in the area. Biomimicry and dematerialization are other areas of industrial development that could be explored in Qatar.

Environmental regulations and standards are an important tool in promoting industrial advancements and sustainable development. Qatar decreased the free residual chlorine limit from

0.1 mg/L to 0.05 mg/L in cooling water.<sup>102</sup> Faced with strict chlorine emissions standards and the need to adequately protect the integrity of production, QatarGas embarked on a multi-year research program. The final result was the implementation of the pulse-chlorination system specifically designed for the biofouling conditions in Qatar,<sup>102</sup> which significantly decreased the use of chlorine and is considered the best available technology for seawater cooling systems in Europe.

## SUMMARY

Qatar is blessed with a rich resource base of non-renewable resources (gas and oil), as well as renewable resources in the terrestrial and marine habitats. The terrestrial and marine habitats form the basis of the unique cultural heritage of Qatar including pearl diving, falconry and truffle collecting. In addition, the uniquely challenging environmental conditions may support specially adapted organisms that could be exploited for advanced biotechnology. However, the current population explosion and meeting the demands of such a population, coupled with expanding industry has placed increasing pressure on all aspects of the natural and cultural wealth of the country. Improved industrial efficiency with technological advancement in concert with judicious labor immigration and urban planning will greatly support the move toward sustainable development. The novel design of cities and industrial cities can lead the way in a move to a knowledge-based society, illustrating first hand how reasoned choices positively influence our standard of living. The sustainable development of Qatar ultimately depends on the complete integration of environmental, economic and social goals for the country, as natural capital of non-renewable resources is transformed into human capital for future wealth creation. The development of each of these areas cannot take place on an individual level since they are part of a complex system that interacts in a multitude of ways. Qatar has the opportunity to take a lead role in the field of sustainable development, by aggressively implementing a comprehensive plan for the development of the country. This plan would include strictly managed natural areas, innovative industrial development and urban design, promoting research and product design while giving Qatar a market advantage as a “first mover”.

The National Development Strategy 2011–2016 (NDS) outlines the values of the country and attainment of those values as we strive for the Qatar National Vision 2030. This is in terms of sustainable development and how future development will take place to enhance those values of environmental management with human and social development. This includes comprehensive healthcare and education opportunities, with education being in the broad sense of having a population prepared to make well-founded decisions. Positive changes in sponsorship laws may result in less immigrant labor and greater automation and Qatari employment, relieving population pressure. Maintaining the traditional social and cultural structure within this environment is a particular challenge, when a major goal is to encourage broader thinking and new models. While the impact of the World Cup has yet to be felt in terms of infrastructure and population increases, the World Cup does offer the opportunity to develop GDP contributors beyond hydrocarbons.

The NDS illustrates that the leadership has a clear understanding of the challenges to be tackled in transforming to a sustainable Qatar. However, population growth has already exceeded that projected in the NDS and implementation of strategies remains difficult. Pursuing sustainable development for Qatar presents a particular challenge due to the reliance on non-renewable resources and the current industrial and population explosion taking place in the country. The challenge remains to motivate the next generation, which may have little incentive and little academic history within the family, to embrace higher education as the country pursues a knowledge-based economy. Despite the challenges, many opportunities in industrial development and technology with smart design await this small country with vast resources and limitless optimism. Ultimately, bold initiatives require bold leadership and Qatar is yet again, blessed with this resource.

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