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Are we sustainable? Promoting a culture of sustainability in planned communities with a sustainability focus

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Sustainability has become a primary concern of new communities worldwide. With regard to planned communities specifically, sustainability planning has taken into account technical environmental standards as well as economic and technological factors. However, planned communities must consider social factors, or their “culture of sustainability” if their endeavors should prove to be truly successful in not only being environmentally sustainable, but also uphold and encourage sustainable human behavior. This paper will first consider the definition of cultures of sustainability. Cultures of sustainability vary from one community to the next and are defined by a strong hierarchy of values. How these values are translated differ, especially as it concerns the structure and governance of a community; values can either be communicated top-down through institutions or bottom-up using a community based-approach. Second, this paper will explore the methodologies communities use to make themselves sustainable. Third, the methodologies and cultures of sustainability explored through three case studies on three different continents: Europe, North America, and the Middle East. Throughout the three case studies, the obstacles and challenges to sustainability and the different forms it takes, environmental, economic, and social, are explored. In this study, it becomes clear that cultures of sustainability must first and foremost take into account the inclusion of the community in decision making processes as well as their embrace of community values and willingness to alter their behavior. Without a shared vision, concrete plan, and sense of community identity, sustainability goals can only last in the short term rather than create a real impact.

In this paper, we address the question of how sustainability practitioners promote a culture of sustainability within planned communities that have strategic sustainability goals. The general argument is that sustainability planning that incorporates technological, economic, and social factors is essential, and a clear vision and implementation plan are necessary to achieve sustainability goals. At the same time, as things do not always go as planned, planned communities must be capable of adjusting to unforeseen circumstances. Moreover, achieving short-term objectives could have unanticipated consequences that may require major revisions of plans and strategies to achieve the central vision.

The argument advanced in the paper is that promoting a culture of sustainability within a planned community will strengthen the sustainability of the community itself. A culture of sustainability, once inculcated within the community,

will produce sustainable behavior. In this paper, we present three case studies to support this hypothesis and identify the ways through which planned communities seek to promote a culture of sustainability to overcome various technical, social, and economic obstacles in order to implement their visions of sustainability. This paper is organized into four sections described as follows.

The first section defines “culture of sustainability” and explains how this definition relates to the notion of sustainability in general. The second section presents two globally recognized methodologies designed for communities to pursue their sustainability goals. The third section includes three case studies of communities, two of which have adopted one of the formal methodologies presented in the second section and the third community in the Middle East has followed an informal approach of its own. The fourth section reviews the lessons to be learned from the planning and implementation of the formal methods and the experiences of the communities described in the case studies, in order to draw some conclusions and provide recommendations for other communities seeking to become sustainable.

Cultures of sustainability

Section: Choose

Sustainability practitioners recognize that any strategy to achieve sustainability goals must incorporate and address two fundamental dimensions, namely technical strategies and behavioral strategies. Technical solutions to sustainability problems go hand-in-hand with behavioral solutions. The appropriate behavior to achieve sustainability is frequently characterized as a “culture of sustainability.” Bertles [1] identified a culture of sustainability as “shared assumptions and beliefs about the importance of balancing economic efficiency, social equity, and environmental accountability,” thus reflecting the three pillars of most sustainability models. According to David Brocchi, [2] sustainability is “a state of mind” that structures our behavior toward environmental, social, and economic interactions. A culture of sustainability is a conceptual set of values that motivate and induce sustainable actions in daily practices. Although scientific and technological advances have an impact on human behavior, technologies and the knowledge required to use them are insufficient to change unsustainable behavior into a sustainable one.

Education and awareness alone are not enough to drive behavioral change. Rather, information and knowledge must be influenced by a strong hierarchy of values that include sustainability. According to Dahl, [3] values such as moderation and justice, which play a crucial role in making communities sustainable, oppose the dominant materialistic values of consumer societies. The real challenge is to deliver those values to people so that they adopt sustainability as a code of conduct.

Sustainability should be viewed as compatible and supportive of a desirable lifestyle. For example, a sustainable lifestyle improves an individual's standard of living because sustainability focuses on “the building of lively cities and communities where people can live, work and play a major role in supporting social and economic well-being”. [4]

Two major challenges are constantly facing the practice of promoting sustainability. The first challenge is whether it should be communicated by a top-down strategy through institutions or by a bottom-up community-based approach through the participation of different stakeholders. [5] The second challenge is the locality of the approach, as there is an emerging global culture of sustainability with fairly recognized beliefs and values that are reflected in and indicated by globally used sustainability indicators and assessment systems. These are highly quantitative and tend to focus primarily on environmental and economic aspects of sustainability. However, when considering sustainability within communities, it becomes necessary to understand local conditions. [2]

Two methodologies for achieving sustainable communities

Section: Choose

Since the publication of *Our Common Future*, many sustainable community models, including methods to achieve the sustainability goal and a sustainable lifestyle, have emerged. The alternative models of sustainable communities have been applied, to a greater or lesser degree, in hundreds of cases worldwide. However, most of the case studies are from Europe and North America, where the models were first developed.

One of the earliest models of a planned community explicitly incorporating sustainability principles was presented by Karl-Henrik Robert of Sweden in 1989. [6] Under the title “Eco-Municipalities,” the model stresses the importance of a shared vision among community members, strategic planning, measurable objectives, monitoring, and continued member participation as the community strives to achieve sustainability. Robert named his approach as “The Natural Step” (TNS) to achieve sustainable communities.

The objective of TNS methodology is to enable existing communities to become eco-municipalities, with sustainability measured against concrete environmental, social, and economic indicators. To date, TNS model has been used mainly by municipalities. In fact, more than 70 eco-municipalities have implemented sustainability plans in northern Europe and

North America. In addition, several multinational corporations operating in Sweden have adopted this model to achieve their own corporate sustainability goals. [6]

In 2003, the United Kingdom established entrepreneurial charity BioRegional, and the WWF (World Wildlife Fund), a global environmental NGO, joined forces to develop and promote "One Planet Living". [7] The name is derived from the concept of the ecological footprint, which is based on the sustainability goal of achieving simple but high-quality lifestyles that are maintained through reduced material consumption and the sustainable use of resources at a level that can be sustained by just one planet Earth.

One Planet Living consists of 10 principles of sustainability as well as a methodological approach to achieving these sustainability goals. The 10 principles include broad but, at present, commonly recognized standards of sustainability. [7] They also include environmentally oriented goals such as zero carbon, zero waste, as well as socioeconomic goals such as equity and the local economy, health, and happiness.

BioRegional primarily works as a consulting agency for sustainable community projects worldwide. At present, there are approximately 20 One Plant Living communities in operating and construction stages. They represent a variety of communities from urban mixed-use residential neighborhoods to larger suburban and peri-urban communities to rural tourist destinations employing workers from surrounding village communities.

This brief state-of-the-art review of major themes in applying sustainability concepts to planned communities is given in order to provide the background to the method and selection process for the following case-study comparison among planned communities. Because of their prominence over contemporary communities of this type, we analyze communities using TNS, One Planet Living, or even their own individual vision model and methodology to achieve sustainability and embed it within the lifestyle of its residents.

Three cases of planned communities with a sustainability focus

Case 1. Beddington Zero Energy Development (Surrey, England)

The Beddington Zero Energy Development (BedZED) is the flagship project of BioRegional and owned by Peabody Trust. This community was established using the One Planet methodology. Therefore, the objectives for developing the community focused on the influence of lifestyles and consumption patterns, aiming to maintain a simple but high-quality lifestyle. The main objective of the community was to create UK's first and largest carbon-neutral eco-community to show that leading a sustainable life is possible while maintaining modern standards. [9]

The BedZED is located in Sutton, UK, and it is a partnership between Sutton Council and Peabody Trust with BioRegional as the environmental consultant. It was clear from the beginning that the developers did not want to produce a cooperative housing; however, they wanted to establish a mass housing compacted development that is sustainable while maintaining a high quality of life that can be replicated if successful. The development consisted of 100 residential units, 1600 m^2 of workspace, and more than 4.1 acres, and was occupied by 244 residents. The residents started moving in during 2002, and since then, BioRegional observed how the community is evolving, collecting data, and producing several reports. The approach toward sustainability in BedZED is both infrastructural and behavioral. The infrastructure approach focuses on basic design features and materials, whereas the behavioral approach focuses on awareness programs and information provided to residents. [9]

BedZED units were designed with local and low embodied energy materials together with facilities for passive ventilation and heat recovery to reduce the need for external cooling and heating equipment. Different types of renewable energy were used in order to meet the energy needs of the community and lessen its dependency on the national grid. A biomass combined heat and power (CHP) plant was constructed to generate heat to produce hot water and electricity, and 777 m^2 of photovoltaic (PV) panels were also installed. All electric appliances inside the units are A rated to ensure maximum efficiency. Furthermore, a graywater biotreatment plant and rainwater-harvesting systems were installed in order to reduce the water needs of the community. [10] Special attention was given to the provision of mixed-use spaces and services such as work areas, cafes, nursery, and health clinic. The residential units were a mix of social housing, shared ownership homes, and private houses, to ensure the social diversity of the residents. [10]

Transportation is one of the main sectors that BedZED focused on while aiming to improve the lifestyle of the residents. BedZED launched a green travel plan aiming to reduce the need of traveling as well as providing alternative transportation modes. The plan first focused on reducing the need to travel by providing onsite job opportunities. The second plan was to reduce frequent trips to supermarkets and shopping areas by developing delivery schemes with supermarkets and local organic food suppliers. BedZED provided the residents access to an internet point and secure storage facilities to store deliveries that are unattended. BedZED promoted alternatives to private car use by introducing home zones where pedestrians and cyclists have priority over vehicular traffic while reducing car speeds to walking

speeds. [11]

The community also provides secure cycle storage facilities and showering facilities for visitors and employees. BedZED negotiated discount rates with local cycle shops while offering free ten-minute bike checks and basic repairs to the residents. All the aforementioned facilities are offered in a welcome pack including local cycling information and cycling maps, aiming to provide incentives for the residents to prefer cycling over car trips. Once a resident purchases a car, he will start using it in all his journeys. Therefore, BioRegional and BedZED focused on developing car clubs that offer rental cars to the residents to provide an easy private car option to them without the need to own one. All of these transportation schemes aim to offer an attractive alternative for residents to change their lifestyle. [11]

Transportation miles were not the only miles that BedZED wanted to reduce, but it proposed a strategy to reduce food miles, too. As most foods travel thousands of miles to reach the consumer, BedZED wanted to encourage their residents to grow their own food and promote the consumption of organic food. Most of the units have access to plot allotments as the residents are encouraged to grow their own vegetables. Vegetable box delivery scheme and information about local farmers and markets are all provided in welcome packets. To make local food more convenient, BedZED opened an organic local grocery store on site. [10]

Waste is always noted as a sector that is directly related to the lifestyle of people [12] ; therefore, BedZED undertook many initiatives for a better waste management inside the community. BedZED equipped kitchens with divided waste bins, allowing the residents to easily separate biodegradable and nonbiodegradable wastes and dispose of them. BedZED launched a community composting strategy to turn kitchen and garden wastes into compost and then redistribute them to the residents to be used in their gardens and allotments as organic manure. BedZED also distributes manuals that provide contacts for recycling or reusing other items that are not collected regularly, together with a resident association that provides guidance on waste management and recycling practices. Such practices have increased the percentage of waste being recycled inside BedZED to 50% compared with only 21% in surrounding areas. [9]

As its name implies, BedZED aimed to achieve zero energy development. Although it has not achieved this goal to date, BedZED's CO_2 emission from heating and electricity is 32% less than other conventional development. [13] This was first achieved by predetermined design decisions such as orientation, insulation, and alternative energy sources. Behavioral strategies were incorporated, such as providing visible water and electricity meters in each unit in the kitchen for the residents to be consciously aware of their consumption. The community provides a green life information service and appoints lifestyle officers to offer information and training on areas such as sorting waste, saving energy, and growing our own food. [9]

Although many predetermined design decisions helped in reducing the environmental impact of BedZED, other decisions were not as efficient as expected or even were completely altered by the lifestyle of the residents. The design of the units involved a sunspace and strategically located windows to provide ventilation in the unit. Unfortunately, the residents did not use the sunspace and windows as expected. Many residents keep their windows closed always because of security reasons; furthermore, the sunspace ended up being used as a storage area by many of the units. The CHP plant received much criticism and was described a failure. First, the plant was designed to run twenty-four hours, but because the residents could not tolerate the noise coming out of it, they restricted its working time to eighteen hours per day. [9] In addition, a problem with the automatic grabs of the CHP for the woodchips, as well as other problems led to its replacement with gas boilers in 2005. [14]

Another source of energy that was originally planned but never ended up being used as expected are the PV panels as they were intended to power 40 electric vehicles. However, the business for electric vehicles did not increase, so it was not an attractive option for the residents to buy electric vehicles. Although BedZED was offering the residents free green electricity from the PV panels, only one electric vehicle was used on site. BedZED ended up using the energy generated from the PV cells in the site and supplying any surplus to the grid. [14] Another way of reducing the fuel car ownership among the residents was charging high car-parking fees. The residents overcame this by choosing to park in the streets surrounding BedZED, which caused disputes between them and the residents surrounding BedZED. Despite these, BedZED achieved a very low car ownership culture among its residents. Ironically, this is not affecting their carbon footprint because BedZED's reasonably wealthy residents fly more than the average UK citizen. [14]

The allotments scheme that was envisioned to promote onsite local food production did not succeed as expected. Residents of some units indicated that they use the allotments as a place for socializing rather than growing food. They regarded the allotments more as a community facility and a seating area rather than a food source. One reason for this could be the fact that the ground turned out to be contaminated; furthermore, the allotments suffered from vandalism as plants and wooden seats have been ripped out in an accident which repelled the residents more. [9] As food production was not taking place inside the plots, the compost produced from the composting schemes was becoming unused, which increased the rat population. [14]

Although many of the initiatives aimed at establishing a sustainable community in BedZED did not work as expected, the

community was flexible enough to overcome such failures and those measures are still described as one of the best practices with very low turnover. It is evident from reviewing a community like BedZED that the more the sustainability processes and technicalities become complicated, the more likely they will end up failing. BedZED is still considered as a success; however, its success does not come from high benchmarks, but from its ability to achieve the sustainable goals with the development of a mainstream housing paradigm.

Case 2. The Resort Municipality of Whistler (British Columbia, Canada)

Communities that are not starting from the ground level such as BedZED but would like to incorporate sustainability in a latter phase tend to choose a different methodology. TNS methodology is commonly adopted within existing communities that aim to become eco-municipalities. Whistler municipality in British Columbia, Canada, is one of the most prominent existing communities following TNS methodology in their approach to sustainability. Located in the Coast Mountains of British Columbia approximately 120 km north of Vancouver, Whistler is one of the premier ski resorts of the world. The town has a permanent resident population of less than 15,000 people; however, its annual tourists and visitors are more than 2.7 million. [8]

The Resort Municipality of Whistler (RMOW) was created in 1975. [8] The resort grew rapidly, and by 2001, the town had reached a permanent population of approximately 9000, about 5000 of whom were resident employees. Another 3000 people commuted to work in Whistler from the nearby communities. Because of visitors, the average daily population in Whistler was approximately 25,000, with only about 25% permanent residents. [15]

Because of the increase in population, both temporary and resident, as well as the huge expansion of buildings, serious ecosystem stresses were emerging, particularly regarding water and waste management. Therefore, a major re-think was crucial. The process began in 1997 when the RMOW initiated a community visioning process that resulted in the *Whistler 2002* five-year plan, which proposed the idea of managed growth and a vision of being "*the premier mountain resort community – as we move towards sustainability.*" [8] This was followed by the *Whistler Environmental Strategy* document in 2000. The big change in direction was triggered in March 2000 with the visit of TNS founder Karl Henrik Robert. His presentations were persuasive, and the Whistler community leadership agreed to adopt TNS model of integrated, comprehensive sustainability planning that could incorporate expectations of future growth while finding solutions to the pressing economic dislocations and cultural issues created by that growth.

With the adoption of TNS approach, Whistler's vision of sustainability moved away from the centrality of environmental stewardship to an emphasis on community inclusion and participation of diverse stakeholders. An "early adopter" group was formed by representatives. Together with the *Whistler Environmental Strategy*, they led to a long-term vision and sustainability strategy presented in *Whistler 2020*. The majority of observers agree that the most important elements introduced by the adoption of TNS approach were community participation, transparency, consensus building, and effective communication. [15]

This does not mean that Whistler has not adopted innovative technologies to address environmental concerns. Whistler and its corporate partners have placed particular emphasis on energy and the reduction of greenhouse gas (GHG) emissions as indicators of environmental sustainability. The target is to reduce GHG emissions within the community progressively by 90% from 2007 to 2090. The target fixed for 2020 is 33% reduction. The community has adopted many programs and projects to achieve the target. [16]

The RMOW applied the LEED (Leadership in Energy and Environmental Design) certification specifications to its new municipal buildings. In addition, the RMOW has installed a heat recovery system from its waste treatment facility to power a district energy system (DES) over parts of the municipality. Two RMOW recreational facilities are powered by geothermal heat exchangers. The municipal vehicle fleet uses biodiesel fuel, and seven electric vehicle charging stations have been installed for public use. There are even solar powered garbage compactors. [17] Whistler has officially collaborated with SolarBC, a provincial agency subsidizing the use of solar water heaters. Whistler Blackcomb has initiated a program of retrofitting its buildings. [15] The company also subsidizes carpooling arrangements for employees who live outside Whistler. To reduce the use of private vehicles, the leading source of GHG emissions in Whistler, the RMOW, has built 40 km of bicycle paths throughout the town, linking the various neighborhood developments to each other. [18]

Whistler's sustainability plan addresses the demographic and income structure of the community in several ways. Perhaps the most important of these is the employee-restricted housing program. [19] Essentially, all new buildings in Whistler are subject to a levy that goes to a fund for the construction of affordable housing units that are restricted to use by Whistler employees wishing to reside in the community where they work. Whistler also developed an "aging-in-place strategy" to ensure Whistler's seniors to afford to live in Whistler after retirement. As revealed by a recent community survey, availability of affordable housing is the most important issue facing the community.

In addition to permanent residents, employees, and nonresident property owners, the RMOW is seeking to integrate recent arrivals and seasonal employees into the community. The "Adopt-a-Youth" program partners first-year residents

and seasonal employees with long-term residents to embed a sense of community in the new residents, and a sense of responsibility within old residents regarding the well-being of the community as a whole. Whistler Community Service Society has established a “reuse it center,” a “rebuild it center,” and a food bank. [20]

Whistler also focuses on spreading the culture of sustainability by embedding it in the community members in order to spread it to their networks. A “Train the Trainers” workshop was developed for the members to develop and deliver sustainability awareness presentations to others in their field, so that the knowledge is not limited to certain members. “*Whistler: It's Our Nature”* is a community engagement program that holds workshops and produces documents targeting sustainability, such as the *Whistler Integrated Sustainability Plan*, the *Sustainable Purchasing Guide*, the *Community Sustainability Toolkit*, and the *Whistler Environmental Strategy*. [21]

Although Whistler municipality has made efforts in planning a sustainable future, engaging and integrating all categories of community stakeholders, not all the programs have worked as planned. Whistler added thousands of employee beds since 2000, but it is still not enough. Local residents tend to rent their units to tourists for a short term rather than to employees for long-term contracts. In 2010, a study concluded that up to 65% of the available rental units were in fact “not listed officially as rental units.” A high percentage of seasonal or shorter-term housing consists of “secondary suites” or self-contained accommodation within a larger residential unit such as a single-family dwelling. Resident and nonresident owners prefer to stay in their units, waiting for higher rates nightly rather than renting it for the whole season. This situation forces the employees of Whistler to leave Whistler and search for affordable living elsewhere. [22]

Such actions have led to a shortage in the workforce during the high seasons of the past few years. A recent study calculated that the workers need to earn CAD630 per week to rent apartments, eat, and use public transportation in Whistler. Nevertheless, the business owners still pay them less and depend on temporary workers. Whistler's workforce started leaving because they cannot sustain themselves anymore. At present, the market in Whistler depends on seasonal visits by low-paid foreigners and students to fill the void. [23]

Whistler's workforce is not the only category facing housing problems; the seniors are facing similar problems. With the continued increase in rent rates and smaller rent pools, the seniors and aging population of Whistler cannot find suitable housing anymore. The only subsidized housing unit for seniors in Whistler is a 30 unit facility, which of course is not covering all the needs. Such problems will eventually affect the diversity of the community, as it will lead to a population without seniors and without a stable workforce, which will in turn affect the economic stability and the social structure of the community. [24]

The efforts to establish green infrastructure in Whistler are not always resulting in expected outcomes. Whistler provided a DES in one of its neighborhoods. The DES was perceived as an environmentally friendly, efficient, and economical one. It is a closed system using a new technology to capture waste heat from the sewage treatment plant and delivers it to homes. Because of constant technical problems and very high maintenance costs, the residents are questioning whether it was worth it. They feel that they are paying more money for the system and are not getting a good quality of heating. Residents are blaming the council for choosing an underperforming extremely expensive technology. The residents stated that they did not want the greenest or the most expensive system, but they only wanted an efficient system, but that is not what they got. [25]

Problems such as those mentioned above lead to doubts in the degree of involvement of the residents in Whistler's vision of sustainability. Are the residents willing to put an extra effort or pay extra money for a greener lifestyle? This concern became very evident when it was announced that Whistler is not going to meet the emission reduction goals set out in *Whistler 2020.* [21] The most significant factor for this failure of Whistler was the increase in passenger vehicle use. Whistler's mayor announced that although many of the residents can walk to their work or ride a bike, they choose not to do that because it is not convenient for their lifestyle. The mayor also stated that Whistler needs a paradigm change in the lifestyle of the residents in order to meet the targets in *Whistler 2020*. [26]

In a case like Whistler, the approach toward sustainability developed recently and the motive was not clear whether it was to protect the environment or to justify growth. Whistler's case is unique in planning and participation, as businessmen, residents, and other stakeholders were involved in setting the sustainability plan. This may imply that the residents are fully integrated and ready to strive toward sustainability. However, this was not the case. The residents are not always keen on following the environmental goal if is not convenient or if it affects their current lifestyle. In fact, several community initiatives were established in Whistler in order to formulate a strong community; however, issues such as housing and rent still exist. This proves that sustainability cannot solve all the community problems. Community initiatives and efficient infrastructure can be established; nevertheless, if the community is not adopting the vision, they will not be effective.

Case 3. El Gouna (Red Sea Coast, Egypt)

Recently, the sustainability phenomenon has also spread in the Middle East. New purpose built communities are being designed and constructed following sustainability measures and plans, such as The Sustainable City in Dubai, UAE, and

Msheireb in Doha, Qatar. There are some other planned communities that were not initially planned to be sustainable, but in their path to development and progress adopted the model of sustainability, similarly to Whistler. El Gouna is one of those cities. As a tourist attraction in Egypt, the case of El Gouna can be of relevance compared with the case of Whistler, although El Gouna is following its own individual plan toward sustainability and not a specific framework or methodology.

El Gouna is located in the Red Sea Governorate, five hours drive toward southeast of Cairo. It was founded as a resort destination by the Sawiris family in 1990, and it continues to be developed and managed by Orascom Hotels and Development Company. The population fluctuates significantly depending on season, and the average population is approximately 18,000–22,000 people. There are approximately 7500 full-time residents, including staff employed by Orascom and other businesses operating in El Gouna. From 2002, the developer has been constantly striving toward the green agenda in El Gouna and launched the Green Gouna Initiative. [27] Sustainability is considered desirable in terms of keeping the real estate enterprise profitable and serving the environmental and social aspirations of the El Gouna community. Sustainability in El Gouna is portrayed as cost-effective and supportive of a desirable lifestyle.

It is important to understand that El Gouna is an economic enterprise. The developers understood that being environmentally friendly is being cost-effective and increasing longevity (S. Zobel, personal communication, March 2016). Currently being recognized as the most environmentally friendly holiday destination of Egypt, [28] El Gouna aims to promote “sustainability” while promoting a high quality of life. El Gouna management encourages the idea that an environmentally sustainable community is also socially and economically a more rewarding and enjoyable place to live.

Although El Gouna was not originally planned to be sustainable, some features in its original buildings helped it to achieve the goal. For example, the original buildings in El Gouna were built with Nubian architecture, which uses passive cooling and reduces the need for air-conditioning, the largest household consumer of electricity. Over time and after the concept of sustainability matured among different entities inside El Gouna, other predetermined design decisions and projects were added or currently under planning. For example, Orascom is currently planning to build a 50 MW solar power plant to meet the energy needs in El Gouna. The majority of the hotels and independent houses use solar water heaters, reducing their dependence on nonrenewable energy resource (S. Zobel, personal communication, March 2016). Orascom constructed two wastewater treatment plants to treat the wastewater of El Gouna and reused it for the laundry as well as for irrigating the softscape (J. George, personal communication, March 2016). The brine from the desalination plant was used to establish fish farms in El Gouna.

El Gouna signed contracts with independent organizations or established specific entities to run different services in El Gouna. For example, El Gouna contracted a waste management company called Irtiqaa to handle the different types of waste in El Gouna. Irtiqaa distributed divided waste bins throughout El Gouna, picked the garbage up to three times a day, and recycled more than 85% of it (H. Samir, personal communication, March 2016). El Gouna also established El Gouna farms, where they raise livestock and grow specific types of agricultural products. By producing food locally, imports from Cairo are reduced, thereby minimizing the impact on the environment. Orascom developed a unique relationship with the government by buying electricity and water and redistributing it inside El Gouna; the residents do not buy electricity directly from the government, and instead, Orascom pays the electricity bill to the government and charges the residents a different tariff. Such a deal helps Orascom to better manage and monitor the consumption of energy and water in El Gouna (T. Hosny, personal communication, March 2016).

El Gouna focuses on establishing a well-integrated and engaged community that understands their vision toward sustainability. It provides various opportunities for community members to engage with one another. These participatory outlets include open forums at the Berlin Technical University campus and “management meetings” held every quarter for people to share ideas, voice complaints, and provide suggestions for improvements. In the management meetings, the general manager sometimes sits with the tenants to hear their issues (S. Zobel, personal communication, March 2016). Having these participatory structures is important for encouraging a culture of sustainability, though there is not an official resident's association. These sessions help members feel that they are being heard by the managing institutions.

In addition, to substantiate this genuine feeling of involvement in the shared community, there exists an email listserv, a customer service hotline for the residents to voice complaints. These platforms for communication and transparency are key for maintaining affiliation. People like to know what is going on in their community as it appeases their sense of well-being and formulates their commitment to the place. They are also more likely to give back to the community, thereby creating a cycle of positive actions that aid to El Gouna's sustainability. El Gouna hosts different events that promote sustainability, such as earth weeks, and organizes beach cleanups. The focus is not only on environmental events, but also on creating festivals and different musical and artistic events, aiming to create a lively, vibrant community.

Although El Gouna initiated different initiatives in order to promote sustainability, not all of them worked as planned. Sometimes, the behavioral or cultural preferences of the residents interfered and sometimes, the plan was not economically feasible or needed new laws and regulations. For example, the waste management company functioning in El Gouna stated that they need to re-sort all the waste coming from El Gouna. Even though divided waste bins are installed throughout El Gouna, the residents are not sorting the waste correctly or did not fully grasp the sorting culture.

Therefore, the company needs to re-sort everything again (H. Samir, personal communication, March 2016). The residents' mistaken perceptions regarding green energy are still interfering with their choices. For example, Oilibya, a gas station operating in El Gouna, tried to sell biodiesel in El Gouna, but the residents did not want to buy biodiesel fearing that it would destroy their engines, due to which the bio-oil station stopped selling bio-oil and continued to sell nonrenewable energy (A. Mohamed, personal communication, March 2016).

Another thing that needed to be altered was the use of treated wastewater for irrigation. Because of the low occupation level in some seasons, the amount of wastewater produced did not seem to be sufficient for the irrigation needs of El Gouna. Therefore, the management needed to buy water from the government for irrigation (J. George, personal communication, March 2016). El Gouna farms, for example, when established, aimed to fulfill the agricultural and livestock needs of EL Gouna, but the agricultural products were found to be very limited because of the lack of fresh water and the high salt content. Moreover, the livestock production could not supply the hotel and tourism sector inside El Gouna because of the tourism laws allowing only frozen products and banning the use of fresh livestock products. Therefore, the production focused on supplying the restaurants and households (M. Michel, personal communication, March 2016).

With regard to establishing a lively community, the numerous social events being held in El Gouna were not preferred by the residents. The residents of the units complained about the high noise levels of music playing in public plazas and restaurants. The residents in El Gouna hated the high seasons of El Gouna and the festivals that attract more number of tourists to the area. Some of the residents stated that they tend to leave El Gouna during the high seasons to avoid the congested situation, as they want El Gouna to be quieter and emptier, not a jammed party place (T. Hosny, personal communication, March 2016). It appears that the efforts made by El Gouna to establish a vibrant lively community is sometimes affected by the lifestyle and preferences of ElGounies (as the residents refer to themselves) who prefer a quieter environment.

Although the concept of sustainability is still an evolving one in El Gouna, it has become clear that similar to the more established cases in North America or Europe, El Gouna is facing some problems, such as the insufficient efforts toward achieving sustainability of the community and improving the lifestyle of the residents. However, it is an ongoing process that keeps changing and adapting to fulfill the needs of the community.

Suggested mechanisms for promoting a culture of sustainability

After reviewing three different cases of planned communities that strive toward achieving sustainability, it is clear that this effort cannot be only limited to infrastructure, technology, and some gadgets, as the lifestyle and behavior of the people can significantly affect the performance of the community. Using technology, many automated gadgets can be installed to reduce the environmental impact of a community. However, most of the sustainability targets cannot be achieved without the willingness of the community members to alter their lifestyle.

In some of the examples discussed above, it is evident that even when installing an efficient infrastructure, if the residents were not involved in the decision-making process, they will not embrace the idea. In other examples, the efforts toward achieving sustainability did not succeed due to low economic feasibility or altered due to market preferences. Therefore, it is important to plan a sustainable community to incorporate the residents within a shared vision, adopting a bottom–up approach and developing a long-term cost-effective study.

Although the three case studies discussed were from different continents (Europe, North America, and the Middle East), the problems that the residents faced were almost the same. It was obvious in all three case studies that lifestyle, convenience, and economic efficiency will always have the highest impact with regard to sustainable initiatives. Convenience and economic efficiency are especially very important when trying to spread the culture of sustainability in the Middle East. As the residents cannot be forced to act more sustainable because it is better for the environment, it needs to be convenient for their lifestyle and economically attractive for them to likely participate in sustainable practices.

Apparently, the three different cases show that a sustainable culture needs to be flexible. Communities need to be flexible and adaptive to failure of some plans and the ever-changing needs, in order to establish a culture of sustainability. The selection of the three case studies highlights the importance of creating a culture of sustainability on the local level, although the same challenges are faced globally. The individual response to the international challenges varies from one region to the other. Although a response can work in one case but fail in the other, adaptation and flexibility to changes will eventually lead to success.

Our review of planned communities with respect to sustainability plans, indicators, and operations identified several scopes that have potential relevance to any developing community in the Middle East that aims to achieve sustainability.

Creating a culture of sustainability in planned communities relies heavily on having a shared vision, a concrete plan, and

sense of community identity. The inclusion of community members in an effort to achieve sustainability is essential. It is evident from the case studies that the strategies planned should be followed for the long term. A successful way to change behavior is bottom-up and consultative approaches to community member participation. This allows residents and community members to directly influence their surroundings. A resident is much more likely to engage in a certain behavioral change if he or she feels part of the decision-making process from the beginning. [29]

A key feature of any sustainable culture is to ensure a high quality of life without causing a negative impact on the environment. Having a vision is a necessary part of identity creation. If the residents find the goals of the community to be legitimate, being embraced and supported by other residents, they are more likely to believe as well. [29] It was observed from our case studies that participation through a shared community identity and membership, community associations, and locations for problem-solving and communication is a key indicator of social sustainability. Behavioral changes, such as lowering consumption of resources, can be achieved only if high levels of motivation are present, and community members can be encouraged and motivated by allowing them to voice their concerns and opening various avenues for public participation. [30]

Positive reinforcement is important to ensure the continued practice of a newly adapted behavior. It is a good idea to foster and support community groups that allow residents to participate in the mission of the community, discuss progress and potential improvements, and learn from each other. It is possible to measure people's interest in the sustainability vision on the basis of the degree and frequency with which they are participating. To create a real sustainable environment, we must not only measure the ecological impacts of the infrastructure, but also influence the behavior of the people within the infrastructure, given that human behavior is an ultimate detriment to the environment. [31] Behavior plays a significant role in properly operating a high-tech environment.

The aforementioned mechanisms are possibly the most important factors for any developing sustainable community to consider, as it tries to promote a culture of sustainability among its members. The method each community selects to implement such mechanisms will differ according to the economic feasibility, codes, and lifestyle convenience. However, using such strategies while establishing sustainable communities will ensure a strong foundation for promoting a sustainable culture, regardless of the actions that will be site-specific to fit the lifestyle. It is important to understand that sustainability cannot be summed up in a set of guidelines or rules and gadgets; instead, it is a lifelong learning process that needs to evolve in each community and adapt to its culture.

Competing interests

The authors declare that there are no competing interests that may influence the interpretation of the results of the study.

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