Enhancing Homes Through Sustainable Optimization

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When thinking about sustainability, people typically think about government policies and dominant international companies first, but it is better to start at a small scale. Instead, first look at homes and how large of an impact one neighborhood could make. There are many accomplished, cost-effective examples to be mirrored partially or completely. In essence, sustainable practices on personal property are practical and highly beneficial, especially when neighbors try to encourage the economy to support sustainable products.

To start, sustainability is strictly about humans prolonging resources among their land. Sustainability is not always about innovative progress or aesthetically pleasing looks. With homes, sustainability can be referred to as "green building," as Patricia Salkin explains: "The green building concept seeks to create structures which are environmentally responsible and resource efficient." Furthermore, subtopics under sustainability include “recycled building materials, energy efficiency, and reducing waste contributing to environmental degradation" (Salkin). A current issue within the population is people not being able to distinguish a problem, understand the whole concept of sustainability, and professional’s vague assertions around sustainability. As an example, "In response to whether the society should spend more effort on preserving the environment 87% replied in favor of greater action and 89% of homeowners believed that environmentally sustainable materials should be used to build new homes" (Teal). In this example, people are in favor of a direct approach to sustainability with clear goals and means. Since people also see the "poorer" neighborhoods of their own community, "rundown" and "dilapidated" homes have unused potential and are simply wasting away. There is no doubt that neighbors believe efficient and sustainable action must be taken.

On a negative note, oftentimes the creation and renovation of homes consumes more resources that leads to an inflation of energy. Obviously, people are not making something that they do not intend to use. However, people do not realize how much harm will be reciprocated after a few years. Especially in condensed areas where, according to Madlener and Sunak, even though “cities account for only 2% of the earth’s surface, they consume 75% of the world’s resources" (Kong). Also, among cities "researchers consider urban areas as heat islands; dark surfaces in cities absorb the sun's heat during the day by 3 to 5 degrees Celsius more than the adjacent lands, and in this way contribute to 30% of air pollution" (HoushmandRad). Furthermore, according to Killip, Sherwin, UNEP.SBCI, and Wood “buildings consume more than 40%

of the world's energy, release one-third of CO2 output, use 25% of harvested wood, release about 50% of fluorocarbon output, make up of 40% of landfill materials, use 45% of energy in operations, represent 40% of greenhouse gas emissions and use 15% of the world's usable water" (Olanrewaju). Looking more singularly at home construction, "The Australian residential construction industry makes up close to 7% of the Gross Domestic Product [GDP] and the construction sector causes approximately 23% of national carbon emissions" (Thomas). In general, homes as a part of cities and buildings are hyper zones of waste, consumption of materials, and loss of money.

As difficult as it is to separate buildings into commercial and residential buildings, the numbers correlate and reflect the same problems reported by homeowners, construction workers, and realtors. These groups, who have very different objectives, consensually agree that government initiatives need to better collaborate so that a greater push can be made. For example, "additional green building requirements, such as white/green roofs and water-efficient landscaping have been included as distinct requirements in some municipalities zoning and building codes" (Salkin). However, these codes are overlooked and not encouraged since the efforts are from individual entities. One example of a government initiative reinforced with the construction industry is the "green building techniques [which] have been standardized, to an extent, by the United States Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system, and the Energy Star rating system" (Salkin). Although, one man who built an exemplary sustainable home noted a fault in LEED-informed system, as seen in Derrick Teal's quote: "Even with an experienced builder and architect, not everyone on the team was necessarily familiar with the intricacies of LEED." There is proof that LEED has gotten a foothold in the construction industry and people are aware of it. Also, LEED is not diminishing like other government ratings usually do, which is a sign of growth.

On a positive note, "Technology…has fostered greater public participation in the process [of creating sustainable solutions] and has enhanced our knowledge of geographic and environmental data to better inform decision making" (Salkin). As an example, Erinn Waldo shares how "…refrigerators have preserved food…[with]…harmful, carbon dioxide-emitting refrigerants…[but]…GE's system instead uses a water-based fluid rather than a chemical refrigerant and magnets instead of a compressor to cool the fridge…," creating a safer appliance for the home, residents, and outdoors (Waldo). Waldo also tells how "…LEDs may be more expensive than traditional light sources, but they last longer, saving money on energy and replacement costs in the long run." Specifically with LEDs, there has been an

influx of popularity, labeled as a "modern" solution. This has allowed manufacturers to invest in the production of LEDs and for people to save money by buying a cheaper product that is also considered an investment. Furthermore, the popularity of LEDs has created ways for technology to improve and exponentially decline the energy use of a home. This is how one element of a home, such as lighting, can make a significant difference in cost while maintaining a sustainable goal.

Continuing with technology, new innovations help homes regulate the indoor and outdoor space. One system, the Geographic Information Systems (GIS), has increased visualization of geography to identify thriving established uses of natural resources, land, and products (Salkin). GIS can be used to find critical information to place or input into sensors. This is seen in Waldo's information about large energy consumers like ventilation systems, which can be monitored with sensor technology so that use is minimal and creates less waste. Another example of this is by mapping wind directions and speeds with GIS by using a sensor that can be alerted to slow down the ventilation system. This can also help preserve large energy consumers.

Another aspect that homeowners can invest in is interior and exterior wood. In the past, wood has not proven its cost effectiveness, however "innovation in wood treatments, wood protection and insulation has provided solutions to these issues so that timber is now a viable option with added benefits such as environmental sustainability and erection speed" (Thomas). There is now a more accessible approach to using wood due to technology, such as the ability to reclaim wood and use recycled material with less waste (Waldo).

Focusing on exterior concerns, large yard plants like trees are the best option to protect personal property. "Trees absorb 9% of solar energy in summer and can also reduce the internal heat of buildings. In residential areas that are in windy areas, planting trees as windbreaks can reduce the cost of heating buildings by 4 to 22% depending on the degree of windiness and density of the windbreak" (HoushmandRad). Trees significantly neutralize weather, especially since "14 of the hottest years have been in the last 20" (Smith). One aspect often not thought about is “the temperature difference between day and night… [which can be reduced by the trees] …absorption of solar radiation [long waves] …" (HoushmandRad). The reason collections of larger plants are preferred is "Due to the expansion of its leaf surface compared to other forms of green space, gardens [with trees and bushes] can increase the relative humidity and softness of the air through transpiration…[so]…a strip of 50 to 100 meters wide reduces the heat by 3 to 4 degrees…[and]…adds 50% to air humidity…" (HoushmandRad). Where a few degrees may not seem like a lot and the length of the gardens too much,

remember that neighbors can come together for a joint operation and split the maintenance. In many cases of sustainability, a slight difference is a big win towards improvement. Usually there is a snowball effect rather than an immediate explosion, which is key to sustaining actions. As an example, "Conifer trees up to 40% and broadleaf trees up to 20% have the ability to capture rainwater and return it to the atmosphere through evaporation," which will amount to more as the tree grows (HoushmandRad). Additionally, the property will have less water drainage over time. Lastly, it is important to know as a property owner that "It's not the gradually increasing temperatures that kill plants [and damage property], it's the increase in extreme events: big storms, big winds, very heavy rain, hail, droughts…" ("A Forest Garden").

Building on the benefits of outdoor plants, it must be addressed on how to make such a biome. One example is "Martin Crawford, an unconventional gardener who grows 500 edible plants with just a few hours of maintenance per month" ("A Forest Garden"). The basic concept of this easy-going method is "…plants of indirect use, system plants to help the system function better and that includes nitrogen fixing plants, mineral accumulators, [and] plants to attract beneficial insects to eat all your pests" ("A Forest Garden"). Why do work when there are plants eager to do it themselves? While the garden may take up more space, logically it is not a problem since it will support more than one household. Also, it is a recreational area where one can take walks, picnics, and generally enjoy nature. Especially in cities, gardens provide benefits like "…produce oxygen, reduce pollution caused by industrial fine dust in the atmosphere, regulate temperature, stabilize soil, beautify the environment, control pollution, and create artificial air arteries and generate wind in cities" (HoushmandRad). Overall, having a small community green area like a neighborhood garden is doable, efficient, and wholly beneficial.

As with any project, having a planned approach to home improvement is critical. Also, it must be recognized that perfection is not the goal, but instead the long-term stability within limits such as cost and space. Ultimately, "Trade-offs are inevitable, so navigating and prioritizing activities can result in positive, less environmentally damaging results" (Smith). Humans cannot be prohibited from acting and developing, so mitigation has a larger effect. Sustainability mostly meshes with human activity and natural activity. Therefore, people should not be concerned about absolute withdrawal from normal activities. For example, solutions like "If you're cold, put on a coat…Don't buy stuff that you don't need…[and]…plant trees…" may seem nice but are not realistic (Smith). Thankfully, there are practical actions such as using heating systems less, buying less one-use items, and planting

trees systematically. Many of these examples have solutions in the making such as the sensor technology mentioned above, LED lighting which has a longer life, and neighborhood green areas that are growing trees. Derrick Teal described his experiences, stating that the largest trade-off in luxury can be offset with interior items as more money is going towards the quality of items. All one needs to do is sit down and do some online shopping to find a good deal and a LEED certified appliance all at once. Mentioning the Australian house project about timber again, "The majority are convinced that timber is the most sustainable material however they have indicated that they would choose a new home built of concrete structural floor and brick veneer," since they believe that new brick homes are more "low maintenance" (Thomas). However, research suggests that wood is not low maintenance, yet people still pay more for lesser products.

It must be addressed that there are "natural limits… [in] …. regard …[to] …economic growth," and so eventually the environmental issue will become greater than the monetary issue (Ims). However, the goal is not to wait for that day. Another issue is socioeconomics inadvertently suppressing sustainability. According to Assadourian: "There will always be a reference group to challenge the individual consumer to obtain a higher standard of living" (Ims). Instead of becoming a selfish society, citizens should look work to help their community by encouraging competitive markets, Earth-protecting practices, and community like "…the royal Thai Sufficiency Economy Model… [which]… involves concerns for employees, the environment, and genuine care for all externalities and for the long-term health of the business" (Ims). In all, the stability of a community's economics and self-identity impacts how sustainable movements can be.

When looking at costs, do not be single-minded since our habits create trends which sway business innovations, concentrations, and economics (Smith). Interestingly, "Companies that are known for environmentally responsible prices are steadily becoming more appealing to consumers," which shows the promise of a sustainable initiative within home products (Waldo). There are discouragements such as the following information from IMRE:

The primary reason architects and interior designers use sustainable products is because they want to, not because they need to…[,] Nearly 60 percent of architects and 56 percent of interior designers identified their own sense of environmental responsibility as the key driver for specifying sustainable products…[,] More than half of the professionals from both industries surveyed agreed that sustainable products are more expensive…[,] 40 percent of architects and 34 percent of interior designers are 'uncertain' if products claiming to be sustainable are actually sustainable…[and] Government and industry incentives are the key driver for only 0.5 percent of architects and 1 percent of interior designers. (“IMRE”)

However, many of these percentages have increased as sustainable product ratings have become known. Technology has evolved public perceptions, and there are more products available like wood treatments. Additionally, "The majority of homeowners also indicated that government subsidies would increase the chance of their selection of sustainable building material" (Thomas). Olanrewaju sums it well by saying "Affordable housing has great potential for sustainability, despite the fact that existing affordable housing stock does not comply with sustainability requirements." However, it is important to not cage the idea of wholly sustainable products, allowing potential for products to develop.

In contrast to negative outlooks, here are several modern examples of working solutions. To begin with, Waldo mentions "Nearly every element, from tile to the oven, is now offered in styles that reduce cost to the environment." This is mitigation at its finest. Also, Olanrewaju mentions that the “research found that all the [sustainable] benefits were obtainable without compromise," which includes affordable housing, and "defined as those for people falling in a medium income range and below…[accounting] for more than 70% of buildings in most countries" (Olanrewaju). To review Derrick Teal's home, the cost was $142 per ft2 after the renovation of the 1988 ft2 home, which in the USA is considered an "affordable house." In all these cases, the “aspects of the quality of life…often [shows] 'less is more' and 'more is less" (Ims). Additionally, now the public must "incentivize ambition and celebrate achievements… [and] …need to measure and communicate the social ethical and environmental impact…," so these sustainable practices can create a snowball effect (Smith).

To end, sustainable homes are real and provide relevant benefits to citizens. Derrick Teal explains that his home “has already come within a shade of net zero [energy use], and he hopes to officially get it to net zero by adding additional solar wattage [with solar panels]." To further support such endeavors, contractors and home industry workers are becoming familiar everyday with sustainable rates shown by Olanrewaju's work, as "82% of the housing professional respondents [121] believed that sustainable affordable housing offered all 23 benefits [from]…5 components: environmental, energy, social, cost and status” (Olanrewaju). This includes anything from nurturing a safer neighborhood to lowering CO2 emissions. As Knut would say, these benefits are a "development,” stating that "While growth is connected to increases in material resources, development is connected to inner peace, imagination, and enjoyment of life in a wide sense." In conclusion, sustainable developed properties are a present solution for happier and healthier neighbors and nature.

Works Cited

"A Forest Garden With 500 Edible Plants Could Lead to a Sustainable Future | Short Film Showcase". YouTube, uploaded by National Geographic, 18 February 2019. A Forest Garden With 500 Edible Plants Could Lead to a Sustainable Future | Short Film Showcase. Accessed 27 September 2023.

HoushmandRad, Mohammad Hosein, et al. "Investigation the Position of Gardens as One of the Dimensions of Urban Vegetation in the Management of Large Cities Located in the Plains and Its Maintenance Strategies." Journal of Practical Auditing & Accounting, vol. 13, Jan. 2022, pp. 13–22. EBSCOhost, research.ebsco.com/linkprocessor/plink?id=17f4af16-9f2f-389b-ad38-4707e265cc7e. Accessed 28 September 2023.

"IMRE Releases New Survey on How Architects and Designers View Sustainability." Wireless News, 9 October 2011. Gale OneFile: Computer Science, link.gale.com/apps/doc/A269293437/CDB?u=park19302&sid=ebsco&xid=4aae87ef Accessed 28 September 2023.

Ims, Knut J. "Quality of Life in a Deep Ecological Perspective. The Need for a Transformation of the Western Mindset?". Society and Economy, 2018, vol. 40, issue 4, p. 22; 531-552. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=bsu&AN=133452082&Custid=083-900. Accessed 28 September 2023.

Kong, Xianzhong, et al. "The Application of Resilience Theory in Urban Development: A Literature Review". Springer Nature 2022, 23 May 2022, Springer-Verlag GmbH Germany. https://link.springer.com/content/pdf/10.1007/s11356-022-20891-x.pdf. Accessed 27 September 2023.

Olanrewaju, Abdul-Aziz, et al. "Housing Providers' Insights on the Benefits of Sustainable Affordable Housing." Sustainable Development, November 2018, vol. 26, no. 6, p. 847–858. EBSCOhost, https://doi.org/10.1002/sd.1854. Accessed 28 September 2023.

Salkin, Patricia E. From Bricks and Mortar to Mega-Bytes and Mega-Pixels: The Changing Landscape of the Impact of Technology and Innovation on Urban Development. Urban Lawyer, 2010, vol. 11, pp. 42-4/43-1, JSTOR, http://www.jstor.org/stable/41307728. Accessed 27 September 2025.

Smith, Alexandria. "Our Sustainability Challenges: The Why, the What and the How, by Alexandra Smith, TEDxWoodLane". YouTube, uploaded by TED Talks, 11 November 2021. https://www.youtube.com/watch?v=qoU3AliSNLM. Accessed 27 September 2023.

Teal, Derrick. "Answering a Sustainable Home Question." Environmental Design & Construction, September 2013, vol. 16, no. 9, p. 12–16. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=buh&AN=91804602. Accessed 28 September 2023.

Thomas, Douglas, et al. "Sustainable Timber Use in the Australian Housing Market: Are Consumers Willing to Pay the Price?" International Journal for Housing Science & Its Applications, 2013, vol. 37, no. 3, p. 187–196. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=a9h&AN=111651564. Accessed 28 September 2023.

Waldo, Erinn. "The Price of a Greener Space." Kitchen & Bath Business, February 2015, vol. 62, no. 2, p. 54–56. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=f5h&AN=101436978. Accessed 28 September 2023.