

# Sustainable Frugal Innovations in Water Sector

Pratik Tawade<sup>1</sup>

<sup>1</sup>Affiliation not available

September 22, 2022

## Abstract:

Water is a basic source and amenity for all life forms on Earth. Still billions of people face water related issues which have a huge impact on their livelihood. Resources and innovations which are cost effective and high quality will increase access and help in addressing the water related problems especially in the resource constrained environments and settings. Frugal innovations have a great potential and a space for contribution in this domain particularly due to the focus on affordable and quality innovations. In order to have a maximum impact of an innovation, it's important to involve consumers as active participants. Frugal innovation allows customization of the innovation to the needs and economic expectations of the user. This article emphasizes on the role of frugal innovation in impairing sustainable solutions to the water-related developmental challenges. It also discusses how different institutions and sectors like private and public can play a key and complementary role in defining and addressing the water challenges using frugal innovations.

One of the most essential components for sustenance of living beings is water. Yet, billions of people lack water and sanitation facilities, 2.2 billion people have no access to safe drinking water and it is projected that water scarcity could displace 700 million people by 2030. Each day, nearly 1000 children die due to preventable water as well as sanitation associated diarrheal diseases [1]. The hydrological cycle, which guarantees that water cycles continually on Earth, provides humans with a number of essential services, including clean water and food as well as natural ecosystems. A rising demand for products and services, including basic needs like shelter, electricity, food, and water, has been caused by economic expansion topped up with population increase, fast urbanization, and industrialization. Additionally, these factors raise demand for home and industrial water, especially in emerging nations [2]. The bulk of the poor and lower middle income nations are found in Africa and Asia, which are also home to the vulnerable areas dealing with water difficulties. Water-related issues are anticipated to have an impact on many processes in multiple industries because of the interdependencies between water and value chains.

The ramifications for those affected by water-related issues can be wide-ranging and may significantly impede wellbeing and development [3]. We require fresh approaches to address enormous water problems. There is a need to go farther in addition to addressing issues on a personal level, including access to clean water. As global collaborations are stressed and business-led solutions and technology are pushed by the Sustainable Development Goals (SDGs) published in 2015 [4], the private sector is increasingly being asked to assist in addressing the major development concerns. The SDGs' concurrent goals of achieving sustainable society, the environment, and economic growth include the sustainable production, circular economy and consumption. Instead of focusing only on the result, this places greater attention on the viability in the social context. This calls for a broader perspective on water resources usage and management in the water sector than only water supply and sanitation (WSS).

Due to their perception of cost and high quality, frugal innovations have been suggested as a feasible strategy for catering to resource-constrained customers in developing markets and also in the low-growing developed

economies [5, 6]. These innovations align with the SDGs, and economical advances are frequently considered as sustainable [7, 8]. However, current research has not carefully examined the sustainability implications and has instead mostly concentrated on the results of frugal innovation, or end goods. If the world is to address the approaching water issue, innovation is required [9]. Particularly for countries that are water-stressed, this is thought to be true. The initiatives, which have various names such as inclusive innovations and bottom of the pyramid innovations [10], aim to promote inclusive development that reduces trade-offs among growth and inequality. The concept of frugal innovation is relatively recent that highlights a crucial component of the innovation process [11]. The term is used to describe innovations created especially for emerging societies that have little or no access to resources [12]. According to this argument, frugal innovation responds to restrictions in resources, whether financial, material, or institutional, and employing a range of strategies, converting these constraints into opportunities.[13]

Gandhian innovation and jugaad [11] are two more names frequently used to describe inexpensive innovation; both phrases stress characteristics with innovative economy. Frugal innovation includes rethinking, not merely redesigning things, business models and production processes. The notion of efficacious innovation has enhanced our knowledge similar to the literature on grassroots innovation and it has increased awareness of the significance of solutions created in the societies where the issues actually exist [14]. It has challenged the idea that innovations are essentially the results of resource-intensive processes and the only province of more developed countries with the financial resources to support significant investments in the advancement of technology. Despite all the attention it has gotten, the concept of frugal innovation is still poorly understood [15]. This is due in part to the difficulties in separating it from other ideas like frugal engineering or reverse innovation [12]. A highly valuable addition is classification of frugal innovation into three categories: frugal attitude, frugal method, and frugal output. It also arranges existing related concepts into these categories. It uses the term mindset to describe both the driving forces behind behaviors and the mental frameworks that influence problem-solving. According to their definition, the term "process" refers to both the production process and the resultant service. When investigating the concept of frugal innovation, the focus has primarily been on engineering, and more particularly, on the producer's inventiveness in being able to reduce the product to its most basic components while yet meeting the demands of the consumer with few resources. It is contradictory to see the consumer as a passive participant in the innovation process. Instead, by actively participating in the production process, the consumer helps the inventor find the sweet spot that permits a considerable cost reduction without jeopardizing the fundamental functions consumers desire to meet with a certain product [16].

The discussion of frugal innovations has been sparked by the realization of the commercial potential of customers with limited resources and the escalating rivalry for these markets. These innovations have gained attention from academics, practitioners, and policy-makers [6, 11]. They have appeared in a variety of fields, from daily use appliances to healthcare equipment to energy solutions. Consumers with limited resources are attracted by frugal innovations in order to provide them inexpensive, high-quality goods and services.

Since the private sector is responsible for the vast majority of frugal inventions, they might also be a way for the industry to start supporting sustainable development. These inventions often aim to satisfy comparatively simple objectives at a cheaper cost and so offer significant value [5]. From a market and technological standpoint, frugal innovations are often unique solutions. Although still a relatively new idea, frugal innovation procedures are still implemented in a variety of ways: some solutions are built from the ground up, while others are based on already existing technology. The solutions in both situations must address the unique requirements in their respective target contexts. Thus, knowing local conditions as well as end users' needs, wants, and behavior is essential for their success. It is suggested that simplicity, simple functionality, and small feature sets are criteria for attaining affordability and essential attributes for the alternatives. Low-cost manufacturing, low-cost materials, and low-cost design are all important considerations. Sustainability of cheap innovations is said to result mostly from the frugal solutions' simplicity and smart design. It is suggested that these characteristics of the results lead to less resource usage and more sustainability. [7]

If the value from innovation is seen to emerge from the supply of not simply a product, but a service described as the process of delivering benefit, it becomes clear that employing the lens of co-production in the conception of frugal innovation is acceptable [17]. For a product to continue to deliver on its promise, it needs complementary approaches, materials, and infrastructure [15]. The importance of the consumer in generating shared value is becoming more widely acknowledged as a result of the service dominating paradigm in marketing. The high level of customer centricity, which implies more than just being consumer-oriented and includes working with and learning from consumers as well as being flexible to their specific and changing demands, is a crucial component of the value that results from frugal innovation. A dominating logic that is service-centered suggests that value is not entrenched in output but rather determined by and co-created with the help of the user. [17]

A more comprehensive understanding of water and the problems it causes can open up new opportunities and widen the scope of an organization's operations. Similarly, a frugal innovation mindset can help organizations to come up with creative ways to organize their innovation and to address the water-related problems faced by less affluent people. Greater markets are opened by recognizing the prospects in the sector of water outside of the companies' typical areas of activity. Affordable solutions are required, especially in low-income areas that frequently deal with a variety of development issues. Prominent umbrella organizations supporting sustainable business have also acknowledged the promise of business-led approaches in addressing the difficulties of sustainable development.

The benefit of frugal innovation is connected with its qualities—low cost, high quality, and environmental suitability—in this expanding water industry. Due to their focus on cost, frugal innovation approaches sometimes necessitate a full rethink of existing operational practices. Assessing the local context is crucial to the growth of frugal innovation practices since they both aim to meet a radical cost target and guarantee that they are appropriate for the area [8]. In this way, cost-effective innovations may inspire businesses to explore fresh approaches to their product development and operational workflows, as well as modify organizational mindsets and operating models.

Furthermore, frugal innovations excel in offering end customers, even those in lower socioeconomic levels, high-quality products at a reasonable price. These innovative approaches can promote sustainable development, especially at the individual and family levels, given that many of these technologies also assist in welfare and the development of livelihoods. When these recent inventions replace unwanted or ineffective behaviors or are more advantageous in terms of the environment, society, or the economy than the existing solutions, this makes a further contribution to sustainability [18]. Issues with the value chains of frugal innovation, which involve numerous phases from raw material extraction through manufacturing, from actual consumption to end-of-life and probable re-use, are directly related to sustainability flaws. Being primarily aimed at customers means that frugal innovations frequently place a high emphasis on product quality, which might cause them to overlook the social, economic and environmental ramifications in other areas of the value chain.

Frugal innovations place a strong focus on the relevance of local context and requirements [19], yet they are frequently produced in a global value chain. These value chains are frequently complicated and involve a lot of individuals in various locations who have diverse traits and features. The need for low-cost production is not always in line with the bottom line of sustainable development; on the contrary, there are instances of well-known corporations that have had difficulty adhering to social and environmental regulations in nations with affordable manufacturing [19]. China, for example, is well-known for its affordable manufacturing, but it also has social and environmental issues connected to its fast industrialization and lacks enforcement of social and environmental rules [20, 21].

Constitutional flaws concern the obligations that all parties should bear in the water sector. The water sector is distinguished by a high level of public sector engagement in and responsibility for the administration and, in several cases, even for the supply of the water services, in contrast to certain other low-cost innovation industries. At the same time, cost-effective innovations created by the private sector frequently only address a single, narrow area relating to the water industry. Even if such isolated innovations may be beneficial,

especially in the near run, they must also take into account the larger societal aspect in which they are embedded; otherwise, they may not help to build more comprehensive, public sector-driven solutions. Such examination also aids in recognizing possible institutional deficiencies and the ways the private sector might recognise and fill them because the institutional environment in developing countries is frequently problematic [22, 23].

The real innovation process typically involves a number of additional players from the public sector, civic society, and academics even though the actual inexpensive innovation procedures are frequently handled by organizations. Public and private sector engagement in the water sector may have somewhat distinct goals, but their styles of operation and areas of expertise may be quite complimentary. However, to fully capitalize on this, it is necessary to be clear about the obligations of each actor. For instance, the private sector may work with various research institutions to provide new products, services, and technologies, while the government sector may foster an environment that fosters these innovations and ensures that the new services support the sector's overarching goals and are available to all. Given the crucial role that the public sector plays in the water sector, from the local to the national and even international levels, it seems obvious that private actors should be aware of this role and collaborate with the relevant public sector players since the commencement of their frugal innovation process. The public sector should continue to play a major role in the development of the overall water sector [24, 25]. This is because private sector actors frequently lack the authority, comprehensive knowledge, and readiness to fill the regulatory gap outside of their immediate areas of responsibility. [26, 27] A solid capacity development strategy is necessary for large scale impact of frugal innovations. activities of frugal innovations should be in line with a country's unique demands. Finally, frugal innovation should support methods to invent that let innovators draw both locally and globally ingrained knowledge, as well as develop the capacities of local innovators and build a vibrant and competitive innovation system, in an increasingly globalized and competitive world. Only then the locally relevant frugal ideas can be created, broadly embraced, and help promote long-term global sustainable development.

## References:

1. Goal 6: Ensure Access to Water and Sanitation for All. <https://www.un.org/sustainabledevelopment/water-and-sanitation/>
2. Rijsberman, F.R. Water scarcity: Fact or fiction? *Agric. Water Manag.* **2006**, *80*, 5–22. <https://www.sciencedirect.com/science/article/pii/S0378377405002854?via%3Dihub>
3. Falkenmark, M. Growing water scarcity in agriculture: Future challenge to global water security. *Philos. Trans. R. Soc. Lond. Math. Phys. Eng. Sci.* **2013**. <https://royalsocietypublishing.org/doi/10.1098/rsta.2012.0410>
4. Assembly, UN General. *Transforming our world: the 2030 agenda for sustainable development, 21 October 2015*. Vol. 16301. A/RES/70/1, 2015. [https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A\\_RES\\_70\\_1\\_E.pdf](https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf)
5. Rao, B.C. How disruptive is frugal? *Technol. Soc.* **2013**, *35*, 65–73. <https://www.sciencedirect.com/science/article/pii/S0160791X13000134?via%3Dihub>
6. Zeschky, M.B.; Winterhalter, S.; Gassmann, O. From Cost to Frugal and Reverse Innovation: Mapping the Field and Implications for Global Competitiveness. *Res. Technol. Manag.* **2014**, *57*, 20–27. <https://www.tandfonline.com/doi/abs/10.5437/08956308X5704235>
7. Basu, R.R.; Banerjee, P.M.; Sweeny, E.G. Frugal Innovation: Core Competencies to Address Global Sustainability. *J. Manag. Glob. Sustain.* **2013**, *1*, 63–82. <https://ajol.ateneo.edu/jmgs/register>
8. Rao, B.C. Alleviating Poverty in the Twenty-First Century through Frugal Innovations. *Challenge* **2014**, *57*, 40–59. <https://www.tandfonline.com/doi/abs/10.2753/0577-5132570302>
9. Lefaive, X., Bouwman, A., Martin-Hurtado, R., Bakker, M., Hilderink, H., Bouwman, L., Witmer, M., Visser, H., Kim, K., Kram, T., 2012. Water. In: OECD Environmental Outlook to 2050. OECD Publishing, pp. 275e332. [https://www.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050/water\\_env\\_outlook-2012-8-en](https://www.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050/water_env_outlook-2012-8-en)
10. Prahalad, C.K., Mashelkar, R.A., 2010. Innovation's holy grail. *Harv. Bus. Rev.*

- 88, 132e141. [https://www.scopus.com/record/display.uri?eid=2-s2.0-84878359548&origin=inward&featureToggles=FEATURE\\_NEW\\_DOC\\_DETAILS\\_EXPORT:1](https://www.scopus.com/record/display.uri?eid=2-s2.0-84878359548&origin=inward&featureToggles=FEATURE_NEW_DOC_DETAILS_EXPORT:1)
11. Radjou, N., Prabhu, J., Ahuja, S., 2012. *Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth*. Wiley. [https://books.google.nl/books?hl=en&lr=&id=6rFt9FwuV4gC&oi=fnd&pg=PR9&ots=HVzTDHnTHQ&sig=5yy79xDHZ2MBYWKSKJ80GLtCFaQ&redir\\_esc=y#v=onepage&q&f=false](https://books.google.nl/books?hl=en&lr=&id=6rFt9FwuV4gC&oi=fnd&pg=PR9&ots=HVzTDHnTHQ&sig=5yy79xDHZ2MBYWKSKJ80GLtCFaQ&redir_esc=y#v=onepage&q&f=false)
  12. Sehgal, V., Dehoff, K., Panneer, G., 2010. *The Importance of Frugal Engineering*. Strategy+Business, pp. 1e5. [https://www.scopus.com/record/display.uri?eid=2-s2.0-80052996759&origin=inward&featureToggles=FEATURE\\_NEW\\_DOC\\_DETAILS\\_EXPORT:1](https://www.scopus.com/record/display.uri?eid=2-s2.0-80052996759&origin=inward&featureToggles=FEATURE_NEW_DOC_DETAILS_EXPORT:1)
  13. Bound, K., Thornton, I.W., 2012. *Our Frugal Future: Lessons from India's Innovation System*. Nesta, London. [https://www.niist.res.in/english/wp-content/files/nesta\\_report.pdf](https://www.niist.res.in/english/wp-content/files/nesta_report.pdf)
  14. Smith, A., Fressoli, M., Thomas, H., 2014. Grassroots innovation movements: challenges and contributions. *J. Clean. Prod. Special Volume Sustain. Prod. Consum. Livelihoods Glob. Regional Res. Perspect.* 63, 114e124. <https://www.sciencedirect.com/science/article/pii/S0959652612006786?via%3Dihub>
  15. Bhatti, Y.A., 2012. What Is Frugal, what Is Innovation? towards a Theory of Frugal Innovation. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2005910](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2005910)
  16. Cunha, M.P. e, Rego, A., Oliveira, P., Rosado, P., Habib, N., 2014. Product innovation in resource-poor environments: three research streams: product innovation in resource-poor environments. *J. Prod. Innov. Manag.* 31, 202e210. <https://onlinelibrary.wiley.com/doi/abs/10.1111/jpim.12090>
  17. Vargo, S.L., Lusch, R.F., 2004. Evolving to a new dominant logic for marketing. *J. Mark.* 68, 1e17 <https://journals.sagepub.com/doi/10.1509/jmkg.68.1.1.24036>
  18. Levänen, J.; Hossain, M.; Lyytinen, T.; Hyvärinen, A.; Numminen, S.; Halme, M. Implications of Frugal Innovations on Sustainable Development: Evaluating Water and Energy Innovations. *Sustainability* 2015, 8, 4. <https://www.mdpi.com/2071-1050/8/1/4>
  19. Tawade, P. Frugal Science: The Science for all. *Authorea*. September 14, 2020. [https://d197for5662m48.cloudfront.net/documents/publicationstatus/47624/preprint\\_pdf/cd7ad1bf3715e3d8f8a67e53680817f1.pdf](https://d197for5662m48.cloudfront.net/documents/publicationstatus/47624/preprint_pdf/cd7ad1bf3715e3d8f8a67e53680817f1.pdf)
  20. Hu, Y.; Cheng, H. Water pollution during China's industrial transition. *Environ. Dev.* 2013, 8, 57–73. <https://www.sciencedirect.com/science/article/pii/S2211464513000894?via%3Dihub>
  21. Yunfeng, Y.; Laike, Y. China's foreign trade and climate change: A case study of CO2 emissions. *Energy Policy* 2010, 38,350–356. <https://www.sciencedirect.com/science/article/pii/S0301421509007083?via%3Dihub>
  22. Khanna, T.; Palepu, K. *Winning in Emerging Markets: A Road Map for Strategy and Execution*; Harvard Business Press: Boston, MA, USA, 2010. [https://books.google.nl/books?hl=en&lr=&id=eBxXLY\\_CnKIC&oi=fnd&pg=PR9&ots=nKaizNtC5g&sig=F1q7hfptWfSZH105L6x85b90IGY&redir\\_esc=y#v=onepage&q&f=false](https://books.google.nl/books?hl=en&lr=&id=eBxXLY_CnKIC&oi=fnd&pg=PR9&ots=nKaizNtC5g&sig=F1q7hfptWfSZH105L6x85b90IGY&redir_esc=y#v=onepage&q&f=false)
  23. Annala, L., Sarin, A., Green, J.L., 2018. Co-production of frugal innovation : case of low cost reverse osmosis water filters in India. *J. Clean. Prod.* 171, S110eS118 <https://www.sciencedirect.com/science/article/pii/S0959652616309532#:~:text=The%20co%2Dproduction%20of%20the,users%20play%20in%20the%20process.>
  24. Plummer, J.; Cross, P. *Tackling Corruption in the Water and Sanitation Sector in Africa: Starting the Dialogue*; Water and Sanitation Programme: Washington, DC, USA, 2006; p. 41. [https://books.google.nl/books?hl=en&lr=&id=Wy-oNmjqj-QC&oi=fnd&pg=PA221&ots=sf79Fbn5RR&sig=CndC2oLGlxVTKLOewuA5rem\\_HfU&redir\\_esc=y#v=onepage&q&f=false](https://books.google.nl/books?hl=en&lr=&id=Wy-oNmjqj-QC&oi=fnd&pg=PA221&ots=sf79Fbn5RR&sig=CndC2oLGlxVTKLOewuA5rem_HfU&redir_esc=y#v=onepage&q&f=false)
  25. Hyvärinen A, Keskinen M, Varis O. Potential and Pitfalls of Frugal Innovation in the Water Sector: Insights from Tanzania to Global Value Chains. *Sustainability*. 2016; 8(9):888. <https://doi.org/10.3390/su8090888>
  26. Mvulirwenande S, Wehn U. Analysing frugal innovation incubation programmes: a case study from the water sector. *Prometheus*. Vol. 36(2):95-115. <https://www.scienceopen.com/hosted-document?doi=10.13169/prometheus.36.2.0095>

27. Sojamo, S. Unlocking the “Prisoner’s Dilemma” of Corporate Water Stewardship in South Africa— Exploring Corporate Power and Legitimacy of Engagement in Water Management and Governance. *Sustainability* **2015**, *7*, 6893–6918.