



(online) = ISSN 2285 – 3642

ISSN-L = 2285 – 3642

Journal of Economic Development, Environment and People

Volume 9, Issue 2, 2020

URL: <http://jedep.spiruharet.ro>

e-mail: office_jedep@spiruharet.ro

Combining the characteristics of sustainability, frugal innovations and washing machines in the industrial nations –

A literature-based analysis of the common features for future sustainable developments

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Abstract. Sustainability is an internationally discussed topic in the development of products and services. Frugal innovations aim to conserve resources in the manufacture and use of such products and services. It can, therefore, be assumed that the areas of sustainability and frugal innovation overlap. This work is intended to show the connection between sustainability, frugal innovations, and household appliances in the form of washing machines in industrialized countries. For the analysis, the characteristics of frugal innovations are compared with the requirements of washing machines in industrial nations, and then the parallels to the social development goals (SDG) are determined as characteristics for sustainability. The existing literature will be reviewed for evaluation. The work aims to show the connection and give an indication of the sustainable development of an everyday product as a frugal innovation in the industrialized countries.

Keywords: sustainability, frugal innovation, SDG, washing machine

JEL Codes: O39, P36

How to cite: Schneider, S. (2020). Combining the characteristics of sustainability, frugal innovations, and washing machines in the industrial nations – A literature-based analysis of the common features for future sustainable developments. *Journal of Economic Development, Environment and People*,9(2)
DOI: <https://doi.org/10.26458/jedep.v9i2.659>

1. Introduction

1.1. Social Sustainability

Since the late 1980s, sustainable development has been increasingly discussed in global politics. The World Commission on Environment and Development, also known as the Brundtland Commission, defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). Elkington (1997) describes the concept of sustainable development in the sense of the Triple Bottom Line (TBL). In his decisions,



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companies should be encouraged to adopt a responsible approach that helps to ensure that the ecological, social, and economic spheres are of equal value. The United Nations formulated 17 sustainable development goals (SDG, Annexe 1), which also mirror the simulations ecological, economic, and social (World Health Organization 2015). These three spheres are often called the three pillars of sustainability. In the past, the social pillar has not received the same attention as the ecological and the economical pillar. Nevertheless, social sustainability is seen as a fundamental component of sustainable development (Colantonio, 2007). In the literature, we found different definitions of social sustainability. Sachs (1999) says “social sustainability must rest on the basic values of equity and democracy, the latter meant as the effective appropriation of all human rights—political, civil, economic, social and cultural—by all people”. Another important factor is the future generation. Social sustainability should enable improvement for present and future generations and use social resources in a healthy way (Khan, 2016). Chiu defines it in nearly the same way, as social sustainability is the maintenance and improvement of the well-being of todays and next generations (Chiu, 2003).

1.2. Frugal Innovations

Frugal innovations are innovations for people with limited resources and a central to the Bottom of the pyramid (BOP) strategies of many international companies. The products and services are simpler in designing and producing (Radjou et al., 2012). The focus is the meet the needs of the masses, developed for the local economy, with minimum raw material to prevent major loss of the resources. The products should be simpler to use, saves money, and have a less carbon footprint. Tiwari and Herstatt (2012) define frugal innovation as following: “Frugal innovation refers to products (both goods and services), processes, or marketing and organizational methods that seek to minimize the use of the material and financial resources to reduce the cost of ownership while fulfilling or even exceeding certain pre-defined criteria of acceptable quality standards.” Firstly these products were developed only for people from emerging markets or BOP markets. Now different research papers show a high relevance of frugal innovations for developing countries in the future. In addition to the sales potential in the growing markets of the emerging markets, there is also a need in the markets of the industrial nations (Bergmann / Tiwari, 2017; Bhatti / Ventresca, 2013; Grassmann et al., 2014; Kroll et al., 2016). The reasons for the development could be, among other things, the more sustainable thinking of each people and the focus from the governments.

The concept of frugal innovation regards the scarcity of resources as an opportunity for needs-based product development. As few scarce resources as possible are used for both production and use. As a result, frugal innovations receive increasing attention from companies, scientists, and political decision-makers. Development takes place across all company sizes and types. These include multinationals, social enterprises, start-ups, and individuals from industrialized and developing countries (Zeschky et al., 2011; Rao, 2013; Radjou et al., 2012). They are particularly important in developing countries, as they address and address sustainability problems in low-income countries, leading to affordability, accessibility, and availability for the populations concerned (Angot / Plé, 2015; Bhatti / Ventresca, 2015).

Various developments in the past lead to possible markets for frugal innovation in several developed countries and TOP-countries (top of the pyramid). For example, the financial and economic crisis, the recession, a stagnant income, and a high level of unemployment (Rao, 2018; RBSC, 2015). Compared with



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the emerging countries the develop countries have their own BOP population. Even if the level is higher than in typical BOP / emerging countries (Angot / Plé, 2015). Probably frugal innovations look a bit different in TOP-countries than in the emerging countries. It will expect that they include more high-tech elements and digital technologies. Also probable is that the sustainability and circular economy considerations are going to be more strongly as in emerging countries (Gabriel et al., 2016). These are the reasons why this work focuses only on the requirements of industrial nations for frugal household innovations.

Furthermore increasing environmental problems and constraints and the scarcity of resources are expected to increase the demand for frugal innovation in price-sensitive and environmentally conscious consumption of industrialized countries (Kroll et al., 2016; Sharma / Iyer, 2012; Cappelli et al., 2010).

In Germany, the development of incomes, the change in the understanding of values, and a growing consumer view with a demand for complexity-reduced products are promoting the trend towards frugal innovations (Grassmann et al., 2014; Tiwari et al., 2017). Likewise, a student survey by Tiwari in 2017 showed a reduced need for status symbols and the increasing importance of social motivations such as environmental awareness (Tiwari, 2017). It is believed that the factors and the individual perceived benefits vary according to the social context.

1.3. Washings Machines

Large household appliances (washing machines, refrigerators, dishwashers, etc.) are an important part of everyday life in industrialized countries. For example, 95% of households own a washing machine (Statista, 2019a). These products thus belong to an important industrial sector of durable consumer goods (Codini et al., 2012). In this work, the author has placed an emphasis on washing machines. For families, they represent a long-term and relatively cost-intensive investment. They are technically advanced, but occasionally require maintenance and/or repair, but then have a long life cycle for the owner (Bressanelli et al., 2017).

Long-life-circle is one of the main factors in the decision to buy a washing machine. In Germany, a good price-performance ratio also influences the purchase decision. Consumers weigh factors such as quality, features, and price. In addition to the price/performance ratio, consumers also consider energy efficiency or sustainability when making their purchasing decision. Appliances should both require little energy in operation and have been produced in a way that conserves resources. Also, consumers want appliances that are user-friendly to operate (Statista, 2016; Codini et al., 2012).

The sales volume of the washing machine has increased over the last years. In 2010, 2.72 million washing machines were sold in Germany. In 2018 the volume increased to 3.42 million units (+25,74%). At the same time, the average price drops from 367.56 € to 333.56 € (-9.25%) (Statista, 2019b). The same development can be observed in other industrial nations such as Hungary. The sales volume increase from 200,000 washing machines in 2010 to 220,000 washings machines (+10%) in 2018 and the price fell from 408.01€ to 375.26€ (-8.03%) (Statista, 2019c).

Washing machines are very popular household appliances, but they are relatively expensive to buy and therefore not accessible to everyone in the industrialized world.



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2. Comparison

All this information shows, there is a need and interest in sustainability, frugal products, and useful household applications like washing machines. In the next step, the important properties of frugal innovations and washing machines are collected and compared with social sustainability. To answer the question, are there common features between sustainability, frugal innovations, and washing machines.

To demonstrate the important properties of a washing machine, Richter (2010) conducted an online survey. Among other things, he asked the participants to evaluate their preferences when purchasing a new white goods appliance such as a washing machine. His survey was conducted with 4 nations (Germany, UK, Sweden and Italy). The results of the research showed that low water and energy consumption are the most important characteristics (83%). Another factor was the cleaning performance (73%). In third place, they assessed the noise level during operation (48%). 37% voted for a low purchase price. The country comparisons show that for almost all countries energy and/or water-saving appliance is the most important. Germany has the highest value with 95%. Richter also states that consumers trust the energy label (Richter, 2010).

Codini and her colleagues conducted a conjoint analysis to determine the relationship between customer benefit and pricing strategies. That's why they use washing machines as household appliances. The results show that in addition to price, energy consumption has a high significance for the consumer. For durable goods, they show an increased awareness of the impact on the environment and the financial life cycle. Such energy-efficient washing machines consume fewer environmental resources and, at the same time, cause lower usage costs compared to less efficient washing machines (Condini et al., 2012).

In 2016 Statista conducted a survey on the important criteria for buying a new washing machine. The participants rated the longevity, the good price-performance ratio, and the quality in the first three places (all-around 78.5%). Sustainability and energy efficiency ranked fourth (60.5%) and ease of use fifth (59.2%) (Statista, 2016).

Various studies are dealing with the identification of the characteristics of frugal innovations. The next sentences are intended to supplement the aforementioned explanation of frugal innovations. Together they show the most important characteristics of frugal innovations. Tiwari and his colleagues conducted a literature analysis and some interviews with experts and focus groups. The results show that one goal of frugal innovation is to raise living standards and improve healthcare. To achieve this, innovations need to take different attributes into account. The results showed that the most important attributes are the functionality of the products. It must also be easy to use and the price should be significantly lower than for non-frugal products. The long-term perspective is also important. The total cost of ownership should be lower than for non-frugal products. Furthermore, robustness and sustainability are identified as important characteristics (Tiwari et al., 2016).

Prahalad also confirms frugal innovation as products with good value for money characteristics, environmentally friendly products with identifying functionality. He also said that for frugal products we have to think about unconventional delivery channels and consider customer education (Prahalad, 2010).



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Frugal innovations and household applications in general have many parallels with the SDG's. Concerning frugal innovations in water and energy, Levänen and his colleagues have already identified 15 of the 17 SDGs as parallels to frugal innovations (Levänen et al., 2015).

The combination of sustainability of household appliances showed O'Connell and his colleagues by mirroring the properties on the 3 pillars of sustainability. Newer appliances bring advantages for the environment (resource-saving use of raw materials), the economy (e.g. increasing usage rates, employment) and society (cost reduction through lower energy and water consumption, improvement of the quality of life through relief in the household) (O'Connell et al., 2013).

In this work, parallels between washing machines and frugal innovations are first searched for and then the suitable SDGs for these compounds are shown. In this way, the connections between the three areas can be determined.

Table 1 shows the comparison of the above findings on washing machines and frugal innovations and finds agreement with the SDG's for comparing sustainability.

No.	Characteristic	Washing		Frugal		Sustainability (SDG)
		machine	Source	Innovation	Source	
1	Long life cycle	x	[5]	x	[12], [18], [33]	9, 12, 13
2	Energy efficient / low water and energy consumption	x	[9], [23], [26]	x	[30], [35]	7, 9, 12, 13, 15
3	Easy to use	x	[9], [26]	x	[30]	-
4	Good price-performance (purchase price and usage costs)	x	[9], [26]	x	[18], [30]	10
5	Cleaning performance	x	[9], [23]	x	[30]	3
6	Less environmental resources	x	[9], [23], [26]	x	[7],[15],[18], [25],[33]	12, 13
7	Raise living standard	x	[27]	x	[2], [15], [30]	3
8	Improve health care	x	[23]	x	[30]	3
9	Consumer education	-	-	x	[13], [18], [31]	4

Tab. 1: Comparison of characteristics.

The table shows economic as well as ecological and social sustainability factors. Economic



sustainability factors include numbers 1, 4 and 5. From the point of view of ecological sustainability factors, numbers 2 and 6 are included. Social sustainability factors include 7, 8, and 9. Characteristic point 3 could not be assigned to any SDG.

Figure 1 shows the overlap between the three areas and the possibility of developing a product that covers all three areas of environmental, social, and economic sustainability.

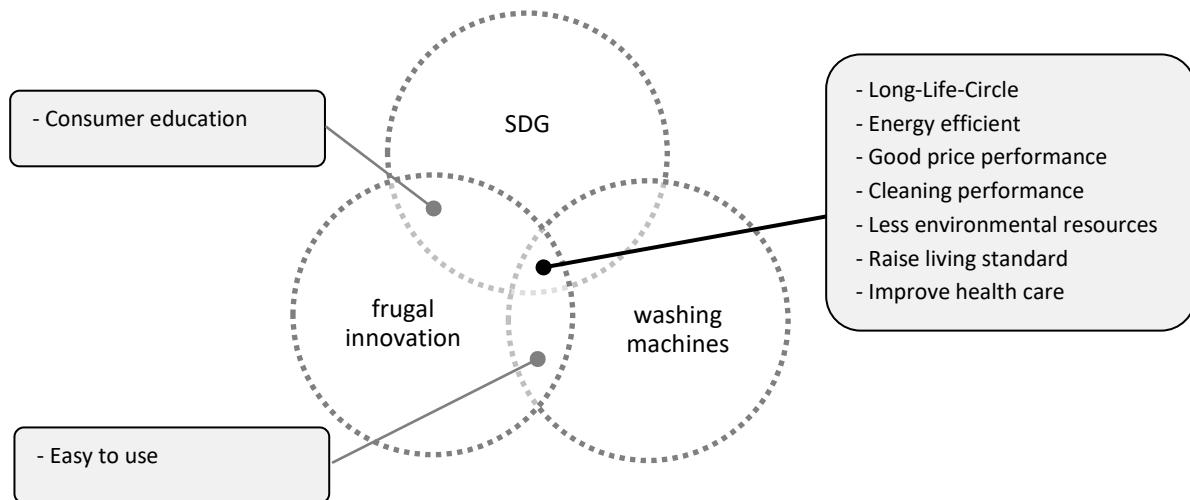


Fig. 1: Overlap between the areas.

3. Conclusion

Sustainability issues are part of today's global environment of political and institutional issues. With the help of sustainability not only the environment should be protected but also the well-being of people should be positively influenced. This includes novel products and services as well as frugal innovations from already known applications.

This paper shows a first comparison of the three areas and that an everyday object can positively influence various areas of sustainability. The washing machine as a frugal innovation could not only become a monetary and resource-saving object but could also improve people's health through cleaning performance. Due to the different starting situations, industrial nations cannot be united with emerging countries in the development of such washing machines. Basically, the requirements for a washing machine will be very similar, but the developed machine will probably have very different characteristics. This is due to the prerequisites, such as the availability of water and electricity resources.



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Finally, it can be said that a washing machine is a sensible and widespread household appliance which, in conjunction with the development of frugal washing machines, can make a positive contribution to sustainability. This paper shows a connection between the three areas that should be considered in the future product development for industrial nations and emerging markets.

In order to protect the environment, issues of sustainability and sustainable products will gain more attention. Besides the pure interest in high-quality sustainable products, consumer acceptance will play an important role in the development (Tiwari et al., 2017) and market establishment of frugal products. According to the findings of this work, the washing machine as a widely used product could be a suitable object for further research on the acceptance of frugal innovations.

Based on the findings of this paper, the author will conduct further research to determine the acceptance of frugal innovations in industrial nations using the appropriate example of a washing machine.

ANNEXE

Annexe 1

Sustainable Development Goals (SDGs) from United Nations

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts



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Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

4. References

- [1] Angot, J./Plé, L. (2015): Serving poor people in rich countries: The bottom-of-the-pyramid business model solution, in: *Journal of Business Strategy*, 36(2), 3-15.
- [2] Bergmann, S./ Tiwari, R. (2017): *Innovationspfade in der deutschen Automobilzulieferindustrie: Eine Untersuchung aus der Frugalitätsperspektive*, Hamburg, Institute for Technology and Innovation Management, Hamburg University of Technology, 2017.
- [3] Bhatti, Y.A./Ventresca, M. (2015): The Emerging Market for Frugal Innovation: Fad, Fashion, or Fit?, Working Paper 2012. Available online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2005983 (accessed on 08 April 2019), 2015.
- [4] Bhatti, Y. A./Ventresca, M. (2013): How can 'frugal innovation' be conceptualized? Said Business School Working Paper Series, Oxford, 2013.
- [5] Bressanelli, G./Perona, M./ Saccani, N. (2017): Reshaping the washing machine industry through circular economy and product-service system business models, in: *Procedia CIRP*, 64, 43-48.
- [6] Brundtland, G.H. (1987). Report of the World Commission on Environment and Development: 'Our Common Future', New York, NY: United Nations, 1987.
- [7] Cappelli, P./ Singh, H./ Singh, J./ Useem, M. (2010): The India Way: Lessons for the U.S., in: *Academy of Management Perspectives*, 24(2), 6-24.
- [8] Chiu, R. (2003): Social Sustainability, Sustainable Development and Housing Development: The Experience of Hongkong, in: *Housing and Social Change: East, West Perspectives*; Forrest, R., Lee, J., Eds.; Routledge: London,UK, 221-239.
- [9] Codini, A./Saccani, N./ Sicco, A. (2012): The relationship between customer value and pricing strategies: an empirical test, in: *Journal of Product & Brand Management*, 21(7), 538-546.
- [10] Colantonio, A. (2007): Social Sustainability: An Exploratory Analysis of Its Definition, Assessment Methods Metrics and Tools; in: *EIBURS Working Paper 2007/01*; Oxford Institute for Sustainable Development (OISD), Oxford Brooks University: Oxford, UK, 2007.
- [11] Elkington, J. (1997): *Cannibals with Forks*, Oxford, Capstone, 1997.



(online) = ISSN 2285 – 3642

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URL: <http://jedep.spiruharet.ro>

e-mail: office_jedep@spiruharet.ro

- [12] Gabriel, M./ Saunders, T./ Engasser, F./ Nowlan, O. (2016): Better for less: Does Europe need frugal innovation?, URL:<https://www.nesta.org.uk/blog/better-for-less-does-europe-need-frugal-innovation/>(accessed on 08 April 2019), 2016.
- [13] Gassmann, O./ Winterhalter, S./ Wecht, C. (2014): Frugal Innovation - die aufstrebende Mittelklasse gewinnen, in: HSG Focus (electricalversion), 2(2), 16–18.
- [14] Khan, R. (2016): How Frugal Innovation Promotes Social Sustainability, in: Sustainability, 8, 1034.
- [15] Kroll, H./ Gabriel, M./ Braun, A./ Muller, E./ Neuhäusler, P./ Schnabl, E./ Zenker, A. (2016): A Conceptual Analysis of Foundations, Trends and Relevant Potentials in the Field of Frugal Innovation (for Europe), Interim Report for the Project "Study on frugal innovation and reengineering of traditional techniques" Commissioned to Fraunhofer ISI and Nesta, Directorate-General for Research and Innovation, European Commission, Luxembourg, 2016.
- [16] Levänen, J./Hossain, M./ Lyytinen, T./ Hyvärinen, A./ Numminen, S./ Halme, M. (2015): Implications of Frugal Innovations on Sustainable Development: Evaluating Water and Energy Innovations, in: Sustainability, 8(1), 4-21.
- [17] O'Connell, M.W./ Hickey, S.W./ Fitzpatrick, C. (2013): Evaluating the sustainability potential of a white goods refurbishment program, in: Sustainability Science, 8(4), 529-541.
- [18] Prahalad, C.K. (2010): The Fortune at the Bottom of the Pyramid: Eradicating Poverty through ~~frugal~~ 2nd ed.; Pearson Education: Upper Saddle River, NJ, USA, 2010.
- [19] Radjou, N./Prabhu, J./Ahuja, S. (2012):Jugaad Innovation: Think Frugal, Be Flexible, Generate Break through Growth, Jossey-Bass, San Francisco, CA., 2012.
- [20] Rao, B.C. (2018): Science is Indispensable to Frugal Innovations, in: Technology Innovation Management Review, 8(4), 49-56.
- [21] Rao, B.C. (2013): How disruptive is frugal?, in: Technology in Society, 35(1), 65-73.
- [22] RBSC (2015): "Think Act Beyond Mainstream: Simply the Best Frugal products are not just for emerging markets: How to profit from servicing new customer needs", Munich, Roland Berger Strategy Consultants GmbH, 2015.
- [23] Richter, C.P. (2010): Automatic dishwashers: efficient machines or less efficient consumer habits?, in: International Journal of Consumer Studies, 34, 228-234.
- [24] Sachs, I. (1999): Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development, in: Sustainability and the Social Sciences: A Cross-Disciplinary Approach to Integrating Environmental Considerations into Theoretical Reorientation; Egon, B., Thomas, J., Eds.; Zed Books: London, UK, 1999.
- [25] Sharma, A./Iyer, G.R. (2012): Resource-constrained product development: Implications for greenmarketing and green supply chains, in: Industrial Marketing Management, 41(4), 599-608.
- [26] Statista (2016): Welche Kriterien sind Ihnen beim Kauf einer Waschmaschine besonders wichtig? Unabhängig davon, ob Sie zurzeit eine Anschaffung planen., URL: <https://de.statista.com/statistik/daten/studie/662590/umfrage/umfrage-zu-kriterien-beim-kauf-von-waschmaschinen-in-deutschland/>, (accessed on 10 April 2019), 2016.



(online) = ISSN 2285 – 3642

ISSN-L = 2285 – 3642

Journal of Economic Development, Environment and People

Volume 9, Issue 2, 2020

URL: <http://jedep.spiruharet.ro>

e-mail: office_jedep@spiruharet.ro

- [27] Statista (2019a): Anteil der privaten Haushalte in Deutschland mit Waschmaschine von 2011 bis 2018, URL: <https://de.statista.com/statistik/daten/studie/516859/umfrage/private-haushalte-in-deutschland-mit-waschmaschine/>, (accessed on 08 April 2019), 2019.
- [28] Statista (2019b): Waschmaschinen – Deutschland, URL: <https://de.statista.com/outlook/16010400/137/waschmaschinen/deutschland>, (accessed on 25 April 2019), 2019.
- [29] Statista (2019c): Waschmaschinen – Ungarn, URL: <https://de.statista.com/outlook/16010400/139/waschmaschinen/ungarn>, (accessed on 25 April 2019), 2019.
- [30] Tiwari, R./ Fischer, L./ Kalogerakis, K. (2016): Frugal Innovation in Scholarly and Social Discourse: An Assessment of Trends and Potential Societal Implications, Hamburg/Leipzig.
- [31] Tiwari, R. (2017): Frugality in Indian Context: What Makes India a Lead Market for Affordable Excellence?, in: Herstatt, C./ Tiwari, R.: Lead Market India: Key Elements and Corporate Perspectives for Frugal Innovations, Heidelberg, Springer, 2017.
- [32] Tiwari, R./ Fischer, L./ Kalogerakis, K. (2017): Potenziale frugaler Innovationen: Handlungsimplicationen für das deutsche Forschungs- und Innovationssystem, Hamburg, Institute for Technology and Innovation Management, Hamburg University of Technology.
- [33] Tiwari, R./Herstatt, C. (2012): India—A Lead Market for Frugal Innovations? Extending the Lead Market Theory to Emerging Economies, Working Paper No. 67, Hamburg, Institute for Technology and Innovation Management, Hamburg University of Technology, 2012.
- [34] World Health Organization (2015): Health in 2015: from MDGs, Millennium Development Goals to SDGs, Sustainable Development Goals. France, 2015.
- [35] Zeschky, M./Widenmayer, B./ Gassmann, O. (2011): Frugal innovation in emerging markets. *Research Technology Management*, 2011, 54(4), 38–45.