
FRUGAL INNOVATION FOR EUROPE



IN COLLABORATION WITH

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INTRODUCTION

Frugal innovation aims to create “more value for more people from less resources”. Frugal innovators use constraints as a prompt for creativity, looking to produce solutions that are much cheaper than alternatives, yet still of good – or better – quality. They do this by prioritising only the features that are most important to users, making the most of under-used assets, finding ways to create value from waste products, and sometimes completely re-thinking an approach.

Because frugal innovations are more affordable, they become accessible for completely new – and often larger – groups of customers. Meanwhile, as they tend to use fewer resource inputs, frugal solutions can – at least theoretically – be more environmentally sustainable.

Much of the current academic discussion on frugal innovation finds its roots in developing and emerging economies, particularly India. However, more and more business leaders and researchers find that it is important for Europe too. This springs partly from a concern that, unless they develop skills for frugal innovation, European businesses might miss out on the growth of “emerging middle class” markets in countries like India and China. On their own turf, moreover, they are facing growing competition from emerging market competitors who are entering European markets with affordable, yet increasingly reliable propositions. Finally, frugal innovation might

offer new opportunities to make the most of European technological expertise, to address European societal challenges and to better meet customer needs in home markets.

During 2016, Fraunhofer ISI and Nesta carried out a study for the European Commission, exploring the potential of frugal innovation for Europe. Through a literature review and case studies comprising over 40 interviews with European managers, entrepreneurs, NGO leaders, academic researchers and technology experts, we aimed to establish:

- To what extent is frugal innovation a market opportunity for European firms – both in emerging economies and in Europe itself?
- To what extent does frugal innovation present an opportunity to create value from European competencies in key enabling technologies?
- What economic, social and environmental benefits could be generated if European firms developed competencies for frugal innovation?
- What could European policymakers do to promote frugal innovation?



MAIN FINDINGS

- 1 Frugal innovation is happening in Europe – even if the term itself is neither widely used nor understood. Our research found examples of European innovators producing frugal solutions in diverse sectors from financial services to health, housing and home technologies. We found a variety of organisations involved, including entrepreneurs and start-ups, established SMEs, multinational corporations, NGOs, Research Technology Organisations, universities and social enterprises. On the other hand, many technology component manufacturers tended to see high-end, premium applications as their primary market and those we spoke to were not, on the whole, interested in exploring frugal innovation themselves. However, there was evidence that some of the solutions they create may later be taken up by others for frugal purposes.
- 2 European firms can strengthen their position in emerging markets by developing frugal products and services – even if our study suggests that claims of many millions of additional customers just waiting to purchase frugal solutions may be intentional hyperbole. By and large, our interviews suggested that frugal business strategies are confronted with market diversity, cultural specificities and institutional challenges just like any other strategy for market entry. Even more so, it requires a detailed understanding of local user needs, i.e. a strong “on the ground” presence or effective local partnerships. Hence, it requires substantial

time and resources. While some European multinationals, such as Siemens or Philips, have successfully made frugal innovation a core strategy for emerging markets, many smaller firms interviewed for our case studies felt challenged or unable to gain access to local networks and resources. There is a growing need for frugal innovation in Europe itself – but this has not yet transformed into large-scale market demand. Initially, we hypothesised that public sector customers would become more interested in frugal solutions as drivers as the refugee crisis, ongoing fiscal austerity and ageing populations put more pressure on public services. Likewise, continued pressure on household budgets suggests that consumers might become more interested in frugal innovations. However, while there is some evidence of growing preferences for low-cost products in everyday retail (e.g. through discounter chains), a broader trend towards frugal innovations remains constrained by a range of factors, such as a preference for the status that comes from purchasing high-end solutions, regulation and standards, and legal entitlements. In many of Europe's health insurance systems, for example, all citizens remain entitled to high-quality, high-specification solutions.

- 3 Most frugal innovations involve the smart recombination of existing technologies for new purposes rather than the development of an entirely novel technology. At their earliest stages of development, technologies are in most cases still too expensive and unreliable to fulfil basic criteria of frugality. In that sense, it appears logical that most component manufacturers are initially not interested in putting the frugal perspective on their agenda. However, evidence suggests that in some fields, development routines could indeed be adapted so that solutions reach a suitable price level and reliability faster – for example, directly after a first demonstration in the laboratory has been successfully performed. So far, however, such processes to consider a “frugal uptake perspective” at an early



stage remain largely absent. Most likely, they would require the engagement of additional, frugally-minded partners beyond the technology developer itself.

4 For the moment, ICT remains by far the most relevant platform technology for frugal innovation. As wireless internet has become widely available, smartphones can now be used to deliver functions which would in the past have required expensive dedicated equipment. Nevertheless, advanced materials have opened up further avenues for the design and embedding of photovoltaics, water filtration materials or electronic circuits in novel contexts of application which would in the past have been limited or excluded by the physical properties of incumbent solutions. Finally, additive manufacturing (3D printing) and the increasing digitisation of production (Industry 4.0) may in future enable cheap mass customisation and, with that, provide further leverage for frugal solutions.

5 Frugal innovation can (and should) generate positive social and environmental outcomes – but this isn't inevitable. In fact, there can be some trade-offs between economic, social and environmental outcomes, for example if increasing access to goods and services increases consumption and resource use. From a sustainability perspective, there is a need to clearly differentiate between economically successful and desirable frugal innovations. With a view to policy, however, it seems obvious that support should be limited to frugal innovations that deliver on all three criteria of sustainability to at least the basic level.

A DISTINCT ROLE FOR FRUGAL INNOVATION IN EUROPE

From both a business and a policy perspective, it is therefore clear that future efforts to develop frugal innovation by, for and in Europe need to focus on solutions that are more than just cheap. European businesses will rarely be successful in marketing innovations by focusing solely on lowering prices. In that segment, boundaries between frugal innovation and cheap mass production become blurred, ethical and regulatory issues keep European firms from competing on the same terms with overseas competitors and technological competence usually plays a subordinate role. Instead, European innovators will need to emphasise quality, durability, sustainability and appeal – whether they are targeting customers at home or abroad.

We suggest that European “niches” for frugal innovation can be found in the following three areas:

- Smart and socially/environmentally responsible “second-cheapest” solutions, aimed at consumers (in Europe or elsewhere) with constrained budgets,
- More affordable solutions aimed to be purchased on large scale by public sector customers and thus justifying dedicated technological development,
- Development aid-backed solutions that specifically aim to solve challenges for “users at the bottom of the pyramid”.

In summary, successful, “technology-based frugal innovation with European characteristics” will require a much broader set of capabilities than the ability to deliver technological excellence. Often, this capacity does not even constitute the main factor for why a specific frugal project succeeds or fails. Consequently, frugal innovation will have to be pursued by other actors with a broader range of capacities than traditional, technology-developing companies.

IMPLICATIONS FOR POLICY

In light of the above, frugal innovation can be considered as an opportunity with considerable potential to generate economic, social and environmental benefits for Europe and therefore merits increased political attention. At the same time, our study provides tangible evidence of bottlenecks and challenges that policy support could help alleviate. These include:

- Mental distance and lack of collaboration between technology developers and frugal innovators,
- Difficulties for European small and medium sized firms in establishing a presence in emerging markets,
- Lack of interest and conservatism among purchasing public authorities,
- Difficulties in achieving the necessary scale to deliver solutions at low cost.

As our study suggests, “technology-based frugal innovation with European characteristics” will likely develop momentum most rapidly, if technology developers that are open to novel approaches join forces with frugally-minded entrepreneurs or challenge-driven public partners. Hence, it will be important to open up future funding or award opportunities to a broader range of stakeholders than before, to involve more entrepreneurs and other partners with a genuinely “frugal perspective”.

In doing so, sustainability should become a key normative criterion for frugal endeavours eligible for policy support. To generate positive impact and help overcome persistent reservations, it is imperative that the resulting activities are not merely profit driven but socio-economically desirable in a comprehensive sense.

POLICY RECOMMENDATIONS

As part of the task, the study developed concrete policy recommendations as follows. In the field of research and innovation policy the study suggests to:

- 1 Champion and promote existing success stories,
- 2 Support the uptake of existing technology for frugal purposes,
- 3 Launch specific calls to nurture more open approaches to innovation,
- 4 Launch specific, challenge-oriented calls under Horizon 2020,
- 5 Develop public-private collaboration platforms for frugal innovation,
- 6 Support international collaboration and learning.

In a more general sense, the study puts forward the following recommendations:

- 1 Reinforce support infrastructure for SMEs on emerging markets,
- 2 Deploy public procurement to prompt business model innovation,
- 3 Use international collaboration as a vehicle to unlock markets,
- 4 Leverage synergies between smart specialisation and frugal innovation,
- 5 Trigger new initiatives in the area of education,
- 6 Ensure adequate regulation and flexibility in exploiting regulatory niches.
- 7 Details on these recommendations can be found in the full final report or the abridged findings.



CASE 1 WARKA WATER

In a case study of **WarkaWater**, the study established that cultural and societal environments can be crucial for the successful implementation and uptake of frugal innovations and that – at the same time – technological development can be important to make them fit for that purpose. Very often, public procurers at different levels of developing countries tend to prefer top-end solutions even if these can hardly be provided for everyone. Consequently, many villages and communities are left with traditional techniques – while they provide a good cultural fit, they cannot offer the social recognition that comes with a modern solution and indeed remain technologically deficient in various ways. Using the example of Warka's water harvesting towers, this study illustrated that while traditional

techniques can be used as an inspiration for the suitable cultural fitting of future solutions – targeted and well-informed technological development of the materials and design can put not only their efficacy but also their socioeconomic impact on an entirely different level. By developing water harvesting nets out of new biomimetic materials, water harvesting installations can be made lighter and more effective at low prices while, in parallel, ICT applications can enhance their basic social function.



CASE 2 OTTOBOCK PROSTHETICS

Using the case of **Ottobock prosthetics**, the study established that there is middle ground in frugal innovation. Most often, frugal prosthetics are illustrated with the example of the Jaipur Leg, an extremely affordable, yet also fairly standardised solution for users living in genuine poverty. Beyond this, however, this study established that even minor technological improvements can yield substantial added value at the lower end of the price spectrum, most notably in combination with delivery and servicing models.

In summary, there was clear evidence that – despite their designer's undisputed ingenuity – “extremely frugal” prosthetic solutions will, at least initially, come with compromises regarding durability, quality and

personal fit that discourage slightly more affluent customer groups. The example analysed in the case study, however, illustrated that a number of these shortcomings can be tackled by the targeted use of existing high-tech while maintaining a substantially lower price level than is common in Europe or in the U.S. With a view to the substantial markets that they could unlock at the lower end of emerging middle classes, such solutions can certainly still be considered frugal. At the same time, the case study underlined that delivery and local training will be central in pursuing this particular ambition.



CASE 3 MAKERSPACES

In a case study on **Makerspaces**, the study documented a dynamic trend towards broader user and citizen involvement in the innovation process. In various emerging economies, most famously in Southern China's IPR free "institutional void", the involvement of many stakeholders in a flexible process of innovation and design has led to the infusion of precisely that understanding of user needs and cultural framework that is key to frugal innovation. Increasingly, these and other related lessons are taken up in a worldwide trend of integrating open piloting environments, enabled by new platform technologies like 3-D printing, in the innovation process. While those engaged in such "Makerspaces" are interested, informed, committed and technologically savvy, they are usually not

(yet) fully qualified in a formal sense, leave alone having gone through the process of establishing themselves as lead engineers with scope for decision. Through such environments, the threshold for participation in the innovation process could be notably lowered and the accessible pool of creativity and market knowledge immensely increased – even where institutional voids cannot be considered an option. Notably, more and more large companies are not only aware of but start to actively utilised the potential of such new platform.

CASE 4 PEEK VISION

By analysing the case of **Peek Vision**, a UK-based firm that has developed a suite of tools to turn a smart-phone into an eye examination kit, this study shows how technological innovation can enable innovations in processes, which in turn generate frugal solutions. As a device, Peek Retina is up to 50 times cheaper than full-specification clinical equipment for retinal photography. Moreover, it has a distinct advantage in the way it enables human resources to be used more efficiently and in a way that enables more people to access services. Peek's solution means that tests can be delivered remotely by workers who are not healthcare professionals, with results sent easily to clinicians who can then advise on whether patients need further treatment or not. In a study in Kenya, Peek found that im-

ages captured by a lay technician with no healthcare background were no different in quality to those captured by an experienced ophthalmic clinical officer. This case study demonstrates that while lower-cost technologies play a role in creating frugal solutions, they are not the only factor in making innovations affordable. This may be even more pertinent in innovations in European health systems, where labour costs are much higher. For example, one interviewee noted that for wrist surgery, fixing fractures with wires has been shown to be equally effective and much cheaper than using metal plates fixed with screws. Nevertheless, for this type of surgery, the cost of either material is dwarfed by the costs of labour.



CASE 5 AFFORDABLE ENERGY EFFICIENT BUILDINGS

With a view to tackling the growing challenge of affordable and durable social housing, a problem that has emerged in developing economies as well, the study underlines the need to establish **affordable energy efficient buildings**. In more developed economies, existing standardised housing will have to be retrofitted in the nearer future at a scale that the market will not be able to address. Hence, existing technological solutions will have to be adapted to develop novel, more affordable approaches to construction and retrofitting. Without further technological input, traditional techniques (like clay architecture) are per se not sufficient to respond to large scale challenges of urbanisation and retrofitting. Moreover, new impulses will be required on the side of public

procurement in both emerging and leading economies – to create initial demand at a scale sufficient to lower cost. In the construction sector, efforts to achieve “more for more with less” require political backing more than elsewhere. Without suitable legislative frameworks, affordable retrofitting to increase energy efficiency would not take place in Europe while, in developing economies, new concepts for mass housing cannot be implemented without government support. In line with other findings, this case study underlines that the good fit with cultural traditions and local social framework will be crucial for successful frugal innovation. Like hardly any other domain, housing is associated with people's daily living.



CASE 6 QARNOT COMPUTING

Qarnot Computing, a French company, found a way to use waste heat from high performance computing for domestic heating, thus linking frugal innovation with circular economy ambitions. It aims to distribute the creation of surplus heat to people's homes by newly designed and affordable radiators that are connected to the internet. With three embedded microprocessors, this Q.rad generates heat by performing remotely allocated computing tasks for commercial clients. By means of specifically developed software Qarnot manages the network of Q.rads centrally and leverages its computation capacity for commercial clients, while at the same time adjusting levels of computation to heating demands. The result is a business model with two separate revenue streams. On the one hand,

Qarnot sells competitively priced computing power to clients such as banks, 3D animation studios and research labs. On the other, it sells Q.rads to property developers who want to install sustainable heating in new or renovated properties. The purchase of a Q.rad includes maintenance and replacement every three to five years and Qarnot refunds users for the electricity consumed by the Q.rad. Each Q.rad records continuously its energy and computing consumption. In the greater Paris area, over 100 households have thus been heated for free since 2014. This case demonstrates how a combination of technological innovation with novel business models can create ecologically sustainable solutions that turn frugal over the period of their lifetime.

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