Conference Agenda

Session

21-AM-07: ST3.3 - Frugal Innovation in the Age of Digital Transformation

Time: **Friday, 21/Jun/2019: 8:30am - 10:00am** *Location:* **Amphi Lagarrigue**

Session Chair: **Gerrit de Waal**, RMIT University
Session Chair: **Cornelius Herstatt**, Hamburg University of Technology
Session Chair: **christian Le BAs**, ESDES
Session Chair: **Fumikazu Morimura**, Kobe University
Session Chair: **Rajnish Tiwari**, Hamburg University of Technology
Session Chair: **Aravind Chinchure**, Symbiosis International University

Session Abstract

In a short span, the concept of frugal innovation has gained considerable acceptance in the scholarly community (Tiwari, Kalogerakis, and Herstatt, 2016; Lim and Fujimoto, forthcoming). They can be broadly defined as products, services, technologies and business models that target “affordable excellence” while minimizing use of resources (Le Bas, 2016; Weyrauch and Herstatt, 2016). Frugal innovations have become increasingly important for ensuring long-term competitiveness of firms in both, emerging market economies and industrialized nations, as current research suggests (Radjou and Prabhu, 2015; Kroll, Gabriel, Braun et al, 2016). In addition, they may be considered as a very useful and important tool in meeting the global sustainable development goals (SDGs), for example by providing affordable access to healthcare and ensuring food security (Chavali and Ramji, 2018; De Waal, Tiwari, and McMurray, 2018).

Nevertheless, the advancement of the scholarly discourse has also brought to fore several new research issues that need attention of the research community. These emerging research issues include, but are not limited to, the following:

• What sectors are especially promising for frugal products and services?

• What determinants are leading the acceptance for frugal products and services in societies that are NOT characterized by extreme resource constraints?

• How can digital transformation contribute to the development of innovative frugal solutions and their diffusion?

• In what ways can frugal innovations lead to a positive impact on ecological sustainability and what limitations must be taken into account?

• Can frugal innovation act as a counter measure to the phenomenon of planned obsolescence?

• What policy measures may be required to mitigate the potential impact of rebound effects?

• What dimensions of affordability (e.g. monetary, societal and environmental) must be addressed by firms while creating frugal solutions?

• What is the role of open global innovation networks in creating frugal technologies?

• In what ways do frugal and social innovations overlap each other?

The special track is conceptualized as a multidisciplinary track that will seek contributions from a variety of sources and welcome papers with both conceptual and empirical focus. The idea is to start a new (next-level) discourse on the phenomenon of frugal innovation and organize a special issue (e.g. of R&D Management) on this theme. We will invite papers from researchers from management sciences, economics as well as from engineering disciplines with the purpose of generating new insights by transdisciplinary integration of relevant themes. We envisage several contributions from R&D-intensive disciplines such as Healthcare, Nanotechnologies that lead to affordable and ecologically sustainable excellence.

Presentations

Frugal Supply Chains? Systematic Literature Review and Empirical Investigation of Best Practices at the Bottom of the Pyramid

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Context

Frugal innovation (FI) originally emerged as a practical response to severe resource-constraints companies face when serving bottom-of-the-pyramid (BOP) markets. By uniquely designing products and processes to deliver high value at significantly lower costs, FI enables companies to capitalize on the vast economic potential BOP markets hold, in a sustainable manner.

Literature

Discourse on FI thus far has focused on describing its end products’ characteristics and understanding their attractiveness primarily in BOP contexts (Pisoni et al., 2018), as well as which characteristics differentiate these products from their counterparts regardless of market context (Weyrauch and Herstatt, 2016). Despite its original coining as the redesign of both products and processes (The Economist, 2010), FI is still studied primarily in the context of its end outcome, products (Rosca and Bendul, 2017). Indeed, through FI, companies have achieved impressive price reductions well above 50%, in comparison with their corresponding product equivalents in developed markets (Rao, 2013). However, when slightly extending the focus from the end-products and into the processes behind them, a different story emerges. The majority of ventures in BOP environments have been significantly less successful in reducing their operations costs, which are often even exponentially higher than their equivalents in developed markets (Simanis, 2012).

Literature Gap

Therefore, there is a strong, practice-driven need to consolidate our understanding on FI processes from existing state-of-the-art, and assess how resource-constraints are felt in the upstream and downstream processes of companies operating in BOP environments, rather than only at FI’s end outcome, its products (Bhatti and Ventresca, 2013).

Research Questions

We aim to build a strong foundation for furthering the FI debate on this crucial gap, by answering:

1) To what degree are processes addressed in existing FI literature, and what are their key characteristics?

2) How do companies at the BOP best achieve these frugal characteristics in their processes?

Methodology

To explore these questions, we adopt a twofold research approach, grounded in both theory and empirics. First, we conduct a comprehensive and systematic literature review (SLR) of FI literature, in order to understand to what degree frugal processes have been addressed in existing research, in which market context (BOP, developing, developed) and what are these processes’ characteristics. During the second research stage, we utilize these key frugal process characteristics synthesized from existing literature and apply them as the comparison dimensions for a large-scale qualitative investigation of the upstream and downstream processes of small and medium-sized ventures operating in BOP markets.

Empirical Material

The ventures included in this study have been proven successful by third-party recognition, for example by winning the prestigious “SEED” award, jointly founded by several prominent institutes to identify outstanding initiatives in BOP markets. As our aim is to empirically assess how companies best achieve frugality in their processes, we decided for a best-practice oriented case-selection.

An Excel database of over 100 ventures was built through extraction of publically available data using a self-developed web-crawler, narrowing down and selection of ventures based on predetermined exclusion criteria (ex. availability of secondary data), then followed by extensive, manual secondary data collection on the chosen ventures’ upstream and downstream supply chain practices (more specifically, divided along procurement, production, distribution and aftersales). The case selection, as well as manual data collection, was carried out by two independent coders, from multiple sources per venture, ensuring triangulation. The sources are rich in nature, often including both text and video, and typically include award websites, the website of the venture, consulting or development agency reports, as well as any relevant data extracted from ventures’ official accounts on different social media platforms (which are often updated significantly more regularly than official websites).

Results

Through this research, we expect to identify clear distinctions in how FI literature has thus far addressed the issue of frugal processes. For example, a clear difference between the foci of FI literature (process or product), depending on whether the research deals with BOP markets or developed markets, with the latter taking a clear process focus. Moreover, additional frugal characteristics that are unique to processes are expected to arise from this analysis, which have thus far been scarcely addressed; for example, flexibility and other time-related performance characteristics. Our findings on how such frugal characteristics can be achieved in processes will systematically and empirically identify patterns of concrete methods and practices utilized by successful ventures in BOP environments. In turn, these will assist the transfer of best practices in different industries and contexts, as well as allow for a more specific, nuanced and empiric-based future research discussion on frugal processes.

Contribution to Scholarship

This paper suggests that there is great potential for research to transfer the focus of FI from its outcomes to its processes, as companies engaging in FI are currently struggling with reducing the cost of their operations more than the price of their products. To the best of our knowledge, this is the first systematic review of FI literature that explicitly takes a process perspective, as well as the largest empirical investigation scrutinizing frugal characteristics in supply chains at the BOP. As such, the findings of this research will be of particular interest to researchers in the FI community who are keen to expand its domain of application, as well as researchers dealing with operational challenges in BOP environments in general, interested in gaining a new lens for understanding supply chain inefficiencies in these resource-constrained environments, as well as means to overcome them.

Contribution to Practice

The findings of this research will be of great interest to practitioners dealing with operational challenges in BOP environments, who can learn how to extend the frugal mindset that has thus far been associated primarily with products, to improve their processes. Additionally, due to a systematic derivation of patterns and concrete examples of best practices drawn from a large number of case studies from a wide range of industries, this paper explicitly contributes to the transferal of supply chain best practices amongst industries and markets across the BOP.

Fitness

The expectation of FI by research and practice to simultaneously drive environmental and economic value creation in BOP markets is ambitious. By extending existing theory to address one of the more pressing challenges of companies at the BOP today, this paper contributes to the cross-fertilization required for achieving these ambitions.

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Frugal innovations for reducing attitude-behaviour gap: An investigating into the diffusion of home energy management systems in Japan

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Context

Home energy management systems (HEMS) constitute a digital innovation for reducing utility costs and contributing to greater environmental sustainability. Even though the Japanese government actively promotes diffusion of HEMS (GOJ, 2012), the diffusion rate is estimated to remain below 3% of all private households by 2020 (Fuji Keizai, 2015).

Literature

Innovation management studies explain consumer acceptance of innovations by positive and negative reasons for attitude and use-intentions. While expected advantages increases the positive attitude towards an innovation, barriers related to perceived value, usage and risks hamper the intention to use it. This attitude-behaviour gap can turn into a significant issue in the adoption of “responsible” products and services. Attitude-behaviour gap can be minimised by designs of innovation (Claudy et al., 2015).

Frugal innovations are characterized by a strategical design that enables “affordable excellence” at substantially lower costs (Herstatt and Tiwari, 2017, Weyrauch and Herstatt, 2016). Compared to established solutions in the market, they focus on essential functions and eliminate avoidable complexity, while satisfying the actual consumer needs in a resource-efficient manner (Cunha et al., 2014).

One reason for the slow diffusion lies in the currently high costs of (over-engineered) HEMS. Therefore, frugal innovations potentially enhance the diffusion rates of HEMS.

Literature Gap

In the past, studies have explored cognitive factors (e.g., domain-specific knowledge) to minimise the attitude-behaviour gap (Bone, 1995; Perera et al., 2016). However, so far, no study is known to have investigated whether and how frugal innovations can help in reducing the attitude-behaviour gap.

Research Questions

The research question underlying this study is: Can frugal innovations help in overcoming value, usage, and risk barriers for HEMS in Japan, and if yes how?

Methodology

A literature review is conducted to identify the current barriers to diffusion of HEMS in Japan. We generate hypotheses by matching these with the attributes of frugal innovations and draw a conceptual framework, which is verified by an empirical survey.

Empirical Material

Data is collected through a scenario-based questionnaire survey of Japanese households based on the panel data of marketing research company INTAGE Inc. At present, we are in the process of conducting a random sampling to extract 1000 responses from 12,083 panels.

Results

Since the questionnaire is currently being implemented, we outline the expected results in the following: First, we expect to find out in how far the lower total costs of ownership (TCO) can reduce the value barrier faced by HEMS. High price is the most frequently mentioned obstacle preventing broader diffusion (Claudy et al., 2015). Since frugal innovations have considerably lower TCO, frugal innovations should face a substantially lower value barrier for the intention to use HEMS in comparison to non-frugal solutions.

Second, frugal innovations reduce avoidable complexity by focusing on core needs. Cognitively, potential consumers can more easily relate to the potential benefits of HEMS (cf. Weyrauch and Herstatt, 2016). We expect the impact of usage barrier to be significantly lower for frugal HEMS than it is for non-frugal HEMS.

Third, we do not expect frugal HEMS to face significantly higher risk barriers than faced by non-frugal HEMS. Consumers are known to reject innovations when they "fear" lower performance levels than required to satisfy their needs (Zeithaml et al., 1993). Frugal innovations are conceptualized as "good-enough" solutions meeting all requisite safety and quality norms in a focused way (Herstatt and Tiwari, 2017) and should be able to allay perceived fears.

Contribution to Scholarship

This research extends the knowledge of attitude-behaviour gap and frugal innovation. It is expected to find out whether frugal innovations can decrease innovation resistance and reduce the attitude-behaviour gap in innovation diffusion.

Contribution to Practice

Results of this research can potentially help firms in devising strategies for faster diffusion of their cutting-edge products. Especially manufacturers of HEMS can identify market segments receptive to frugal solutions. In addition, the study provides useful leads on how governments can develop effective strategies to promote the installation of HEMS for meeting environmental objectives.

Fitness

This research connects with this year's conference theme of meeting "the innovation challenge" by "bridging research, industry and society" with the means of digital transformation. It also connects with the relevant track's (3.3) scope of identifying promising sectors for frugal products and services as well as their determinants of acceptance.

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Affordable Green Excellence through Digital Transformation: Evidence of Frugal Innovations in the Wind Energy Sector

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Context

Achieving the sustainable development goals (SDGs) necessitates access to affordable and clean energy. Renewable sources of energy have been, however, expensive and often functioned with government subsidiaries. Emerging evidence from wind power suggests that digital transformation is enabling the industry to create frugal solutions that enable affordable green excellence.

Literature

Frugal innovations substantially reduce total cost of ownership (TCO) by focusing on core functionalities and optimizing performance levels (Weyrauch & Herstatt, 2016). However, their contribution to environmental sustainability has been considered as an accidental, even if positive, by-product of enhanced resource efficiency (Le Bas, 2016; Weyrauch & Herstatt, 2016).

Wind power production is concentrated in few nations. Top-10 countries account for 85% of the globally installed wind power capacity. With the exception of China, India and Brazil, all others are industrialized economies (Tiwari & Tiwari, 2019). Prohibitively high costs of wind power installations have acted as a deterrent for their diffusion in the past, but more recently wind power has emerged as "the least-cost option for new power capacity in a large and growing number of countries" (REN21, 2018). Digital technologies are being increasingly employed to enhance resource efficiency and reduce costs (CEMAC, 2017; GWEC, 2018).

Literature Gap

Frugal innovations have been conventionally associated with low-tech solutions from developing economies. The potential of digital transformation as an enabler of high-tech, environmentally sustainable and yet-affordable solutions is an under-researched topic. There is no known study of advanced frugal solutions in the wind power sector.

Research Questions

This explorative study investigates if digital transformation is being employed by wind turbine manufacturers for creating affordable, efficient and reliable solutions. Moreover, it seeks to understand in what are digital technologies can help in achieving frugal solutions.

Methodology

This explorative study uses a mix of conceptual and case-study based approaches. A literature review examines the compatibility of frugality with environmental sustainability and identifies “hot spots” that need to be redressed. In a second step, innovation strategies of top-10 global wind turbine manufacturers are analysed regarding elements of digital transformation, frugality and environmental sustainability. The analysis, enriched by 3 interesting cases of innovation, is based on publically-available company documents, scientific publications and media reports concerning the period 2013-2018. The generated insights are used to propose a conceptual model that combines digital transformation with affordable and green excellence.

Empirical Material

This paper develops a conceptual model, that draws on insights from the wind power sector. We analyse annual reports of top-10 global wind turbine manufacturers for the period 2014-18, in addition to analysis of scientific publications, other company documents and media reports.

Results

The results indicate that the wind power sector has undergone a substantial structural change in the recent past due to withdrawal of government subsidiaries for feed-in tariffs. Moreover, China and India have emerged as key markets advancing to globally first and fourth market position (2017) respectively. As a result, wind turbine manufacturers have integrated frugal innovation strategies to respond to the enhanced need for resource efficiency and cost reduction. Digital transformation has acted as a key enabler in this process. Analysis of annual reports of global top-10 wind turbine manufacturers reveals an increasing emphasis on digital technologies in their innovation strategies.

Digital transformation in the wind power sector generally involves leveraging of big data, analytic tools, and software applications that target three performance objectives: (a) yield improvement, (b) higher reliability, and (c) reduction in operational costs. Predictive models are built based on collection and visualization of real-time data related to weather, status of components, service reports and performance of similar installations enabling benchmarking. Availability of such data at turbine, farm and fleet levels has helped firms to develop maintenance strategies, including cyber security, that reduce down time at wind farms, enhance energy production and achieve better unit costs.

Contribution to Scholarship

The study is first of its kind to connect digital transformation with frugal innovations in the wind power sector. The case studies and the analysis suggest that it is possible to create frugal innovations using high-tech solutions and also in the economically developed nations. The research, therefore, contributes to theory-building by taking the scholarly discourse on frugal innovations to the next level. The study, despite its exploratory character, demonstrates that it is possible to inherently integrate environmental sustainability in the design of frugal solutions leading to “affordable green excellence”. The conceptual model, identified in the study, and the amended definition of frugal innovations proposed herein, have the potential to impact the scholarly understanding of frugal innovations in the long-run.

Contribution to Practice

Our study has potentially important implications for the practice on three levels: (a) It shows the mechanisms of how firms can create high-quality frugal solutions by implementing digital transformation, (b) it shows the large potential for frugal innovations in the wind power sector worldwide, which is required to meet the SDGs, and (c) the study has strong policy implications for creation of frugal solutions in the field of renewable energies.

Fitness

Our paper focuses on SDGs and fits excellently with this year’s conference theme aiming at bridging “research, industry and society” through innovation. The paper connects with Track 3.3 as it shows how digital transformation can contribute to the development of innovative frugal solutions with a positive impact on ecological sustainability.

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Frugal Digital Innovation: An Ecosystem View

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Context

The context in which “frugal digital innovation" takes place is typically situated outside the traditional boundaries of the firm, within ecosystems where digital and social capabilities are shared among various participants. This results in ecosystem-wide economic, societal, and environmental impacts (Ahuja & Chan, 2016; Tiwari & Herstatt, 2012).

Literature

The extant information systems (IS) literature highlights the enabling role that digital technologies play in the development of frugal innovation capabilities (Ahuja & Chan 2014; Watson et al., 2013). Digital technologies such as SMAC (Social media, Mobile, Analytics, Cloud) provide new types of capabilities for affordable, scalable, and sustainable business models, products, and services (Autio et al., 2018).

The extant literature on business ecosystems suggests that participants co-evolve their capabilities and roles to align themselves with mutually beneficial outcomes for their communities (Moore, 1993). In a frugal ecosystem, resource constraints, social challenges, and institutional voids are prevalent, making innovation difficult (Khanna et al., 2005). Yet, we see ingenious digital innovations such as mPESA and GE-ECG machines emerge from frugal contexts (Agnihotri, 2014). We view frugal digital ecodynamics (El Sawy et al., 2010) as the fusion of digital technologies, resource constraints, and ecosystem-wide capabilities to the point of inseparability.

Literature Gap

Although digital ecodynamics and co-evolution of capabilities is well established in the MIS literature, it has got limited attention in a frugal innovation perspective. This paper will address this gap in the literature and study the co-evolution of digital capabilities and their impacts in

a frugal ecosystem.

Research Questions

How do firms develop and orchestrate frugal digital capabilities in a resource-constrained ecosystem?

How do digital technologies drive frugal innovation in a resource-constrained ecosystem?

How are economic, environmental, and social impacts generated using frugal digital innovation capabilities?

Methodology

We adopt a qualitative approach that is driven by inductive theory building with multiple cases (Hallen & Eisenhardt, 2012; Santos & Eisenhardt, 2009). Multiple (vs. single) cases enable building robust, generalizable, and parsimonious theory (Eisenhardt & Graebner, 2007). Multiple case studies also allow for the examination of a multi-faceted phenomenon while permitting “retention of holistic and meaningful characteristics of real-life events” as well as the “retention of contextual conditions” (Yin, 2013). To improve the likelihood of detailed and accurate theory, we analyze various digital technologies, capabilities, and relationships that drive frugal innovation within resource-constrained ecosystems.

Empirical Material

The firms were selected via a careful search and categorization exercise utilizing a large, web-based, global directory for firms that identified with engaging in providing affordable products and/or services. The data presented here are part of a larger study, where more than 25 firms in India (along with business incubators and ecosystem participants – partners, developers, suppliers, customers, government agencies, think tank representatives, incubator managers, etc.) were interviewed. The researchers conducted more than 70 in-depth, in-person interviews as well as web-based and phone-based interviews and surveys in India, during 2016 to 2018. We present a subset of these interviews.

We began by interviewing the founders of the firms. Then, we interviewed key technical and managerial representatives of the firms. In order to corroborate this internal perspective of the firm with external perspectives, we interviewed other members or participants of the ecosystem of these firms. These included partner organizations such as NGOs, city and municipal organizations, think-tank firms that helped them strategize, and social media and marketing firms that helped them create branding and marketing campaigns. To further triangulate these data, we interviewed the customers of these platform firms who most often belonged to the bottom-of-the-pyramid.

Results

Potentially, the results will highlight the following:

1) So far, very little is known about how firms combine digital technologies in order to achieve frugal innovation. This is often treated as a black-box that is internal to the firm. We open this black-box and provide insights into the process of leveraging SMAC solutions, infrastructure, and platforms for frugal innovation.

2) We hope to learn how firms respond to resource constraints and institutional voids and overcome them using both digital and social mechanisms.

3) We hope to learn how firms orchestrate ecosystems by engaging with partners, service providers, governments, and driving adoption via use of both digital and non-digital channels.

4) We hope to uncover the process of impact generation where the focus of the firm is on creating innovative solutions that not only impact profitability but also create broader economic, environmental, and social change.

5) We hope to learn about socio-digital and socio-economic relationships among various entities involved in this type of innovation.

Contribution to Scholarship

We expect to make the following contributions to scholarship on frugal innovation and digital transformation:

1) Extend the discussion on frugal innovation by grounding it in a theoretical lens emerging from the information systems discipline, i.e., digital ecodynamics

2) Integrate the separate literature streams of digital innovation and frugal innovation. Our findings on "frugal digital innovation" will be at the intersection of these literature domains and represent a novel contribution.

3) The novelty of our findings will guide the extension of theories in digitalization and innovation. By theoretically and empirically investigating how frugal digital innovation takes place in resource-constrained ecosystems, we are making an important contribution to the management literature.

4) This article will show how the outcomes of leveraging digital technologies for frugal innovation go beyond economic impacts alone and will emphasize social and environmental benefits.

Contribution to Practice

With issues of affordability and sustainability gaining global attention, developing a more holistic innovation agenda is imperative. As digitalization of innovation becomes more mainstream, digital technologies will play a focal role in the orchestration, coordination, and organization of the participants within ecosystems. This article highlights the crucial role that digital ecodynamics can play in a frugal environment and the strong societal impacts that can be generated. The case studies display fusion of digital and physical assets orchestrated by community-based participants who often belong to under-privileged and socio-economically challenged sections of society.

Fitness

The article is aligned with the overarching theme of "Bridging research, industry, and society" in that it highlights research on frugal digital innovation, highlighting the fusion of the physical, social, and technological resources and capabilities to develop affordable, scalable, and sustainable solutions for economic and societal impact.

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